AVIATION

The Oldest American Aeronautical Magazine

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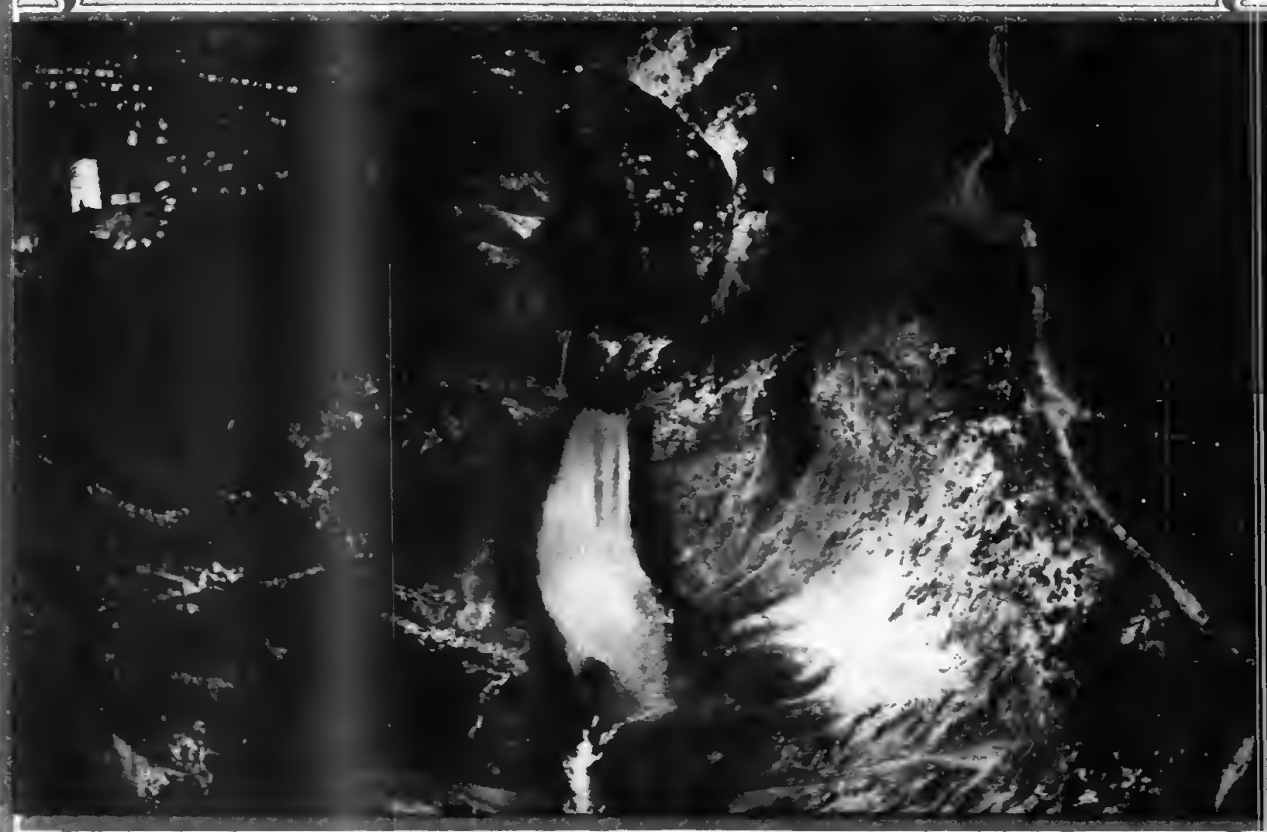

Yellowstone Falls Seen from the Air

VOLUME XVI **NUMBER 3**

SPECIAL FEATURES

REPORT OF THE NAVAL ARCTIC AIR BOARD

AIR APPROPRIATIONS IN THE 1924-25 BUDGET

PLANS FOR THE 1924 INTERNATIONAL AIR RACES

FRANCE DEVELOPS MULTI-ENGINED TRANSPORT PLANES

THE GARDNER, MOFFAT CO., INC.

HIGHLAND, N. Y.

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CONTENTS

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AVIATION

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Air Legislation and Terminology

FOR the second time the Senate has passed the Bill introduced by Senator Wadsworth of New York for the regulation of air navigation, and it is confidently expected that the House will shortly do likewise with the "Civil Aeronautics Act" introduced by Representative Winslow of Massachusetts. Should this come about, it is understood that a compromise bill embodying the best features of the two measures will be worked out in conference and submitted to Congress for final passage. Thus, the hopes that federal regulation of air navigation will be an accomplished fact this year are higher than they ever were before.

In this connection it seems necessary to call attention to some of the terminology used in the Winslow Bill. Most important of these, of course is "airman." This word has been used to designate "any individual (including the master, and any pilot, mechanic or member of the crew) engaged in the navigation of aircraft while under way, and any ground engineer engaged in the inspection, overhauling or repairing of aircraft." This all inclusive word seems entirely satisfactory as a generic term for general use, and was included at the suggestion of aeronautical advisers. It would be a good practice to popularize this word by referring to the armed forces of the United States as "the soldiers, sailors and airmen" of the country. It would, in particular emphasize the important role the air is assuming in national defense.

Other new terms used in the Winslow Bill, such as "facility" and "master" may prove more difficult to popularize, but the reasons for their inclusion seem sound.

Altogether, the terms used in the Winslow Bill appear to be well chosen and well defined. They should be adopted and used as widely as possible, particularly by the daily papers, some of which still call an airplane an airship.

Multi-Motored Transport Airplanes

FROM the extensive operation of aerial passenger transport in Europe under greatly varying physical and technical conditions there is slowly crystallizing a volume of experience which is deserving the closest attention of those concerned with commercial air transport. One of the cardinal points of this experience is the apparent need of multi-motored planes on routes where the ground organization or the physical aspect of the ground do not offer ready and frequent emergency landing fields. The other point is the desirability of substituting for the now common system of flying a course by following landmarks the more scientific and positive system of air navigation by means of instruments, which has aptly been called "direct course flight."

Both these points have a direct and powerful bearing on the safety of air transport, and thus are apt to influence the future growth of commercial aviation to a very considerable degree. The drawbacks of possible engine failure, the greatest single factor in the present comparative uncertainty of commercial air transport, could, it is generally conceded, be almost entirely overcome by multi-unit power plants. Though their use may not forestall all the consequences of engine failure, it offers at any rate fair assurance that such an airplane would always be able to reach an emergency landing ground even though one of its engines has failed. Twin-engined planes are generally regarded as unsuitable for this purpose for the failure of one engine reduces the total available horsepower by too great a margin to allow of safe horizontal flight for any length of time. While it is true that with three and four engined ships the so-called mathematical probability of engine failure is increased—since there are more gadgets and moving parts susceptible of failure—it nevertheless seems reasonable that in practice three or four engines will give a commercial airplane a greater factor of operational safety than one or two engines.

As to the general adoption of direct course flight, experiments made by the Army Air Service and the Air Mail Service seem to show that in most cases where airplanes would be incapable of reaching their destination in fog or low hanging clouds by using ground bearings, navigation by direct course methods at altitudes out of reach of local weather disturbances generally insures the successful completion of the flight. Hence the general use of direct course methods would greatly increase the security and dependability of public air transport.

1924 Pulitzer Races

WITH the announcement of Dayton as the place for the next international air race meet, there comes to us word from Paris that six or seven French constructors are building new pursuit planes to take part in the 1924 races. They have great confidence in their ability to beat the speed records that have been made in this country last year. Another group is building seaplanes to try to regain the Schneider Cup.

This is splendid news, for it means that the rivalry which has been confined to our Army and Navy Air Services will become international in scope. Holding the world's speed records, as we do, there would be little incentive to build new types unless pressed by possible foreign competition.

The invitation extended to foreign aero clubs on behalf of the National Aeronautic Association by G. S. Johns so promptly after the St. Louis races has evidently been considered favorably and the possibility of a real international competition this year will create a greater interest in these events than ever before.

The visiting contestants may be assured that they will receive a most cordial welcome from the American aeronautical community and that they will be granted every facility for adequately preparing their chances of success in the forthcoming races.

Planning the 1924 International Air Races

By H. W. KARR

Assistant to the President, National Aeronautic Association

The selection of Dayton as the most desirable site for the 1924 International Air Races will afford a fitting means of dedicating the new 5,000 acre aviation field east of Dayton which was bought by public-spirited citizens of Dayton and donated to the government.

To be held Oct. 2, 3 and 4

The aerial classic will be held there Oct. 2, 3 and 4, 1924, according to tentative arrangements, and will bring leading figures in national and aeronautical affairs here from all over the United States and many parts of Europe and the East.

Invitations to attend the Races will be extended by Frederick B. Patterson, president of the National Aeronautic Association, to President and Mrs. Calvin Coolidge, Secretary of War John Weeks, Secretary of Navy Edwin Denby, and others high in the nation's affairs.

The tentative date calls for the Races being staged on Thursday, Friday and Saturday. This will give many persons an opportunity of attending on the Saturday half holiday. A preliminary program has been prepared by the Contest Committee of the National Aeronautic Association and submitted to the Dayton Chamber of Commerce for approval.

The Races are the spectacular side of the National Aeronautic Association and are one of a number of aerial entertainments which will be held in America this year under the supervision of Mr. Patterson. They include six annual events, foremost among which is the high speed contest for the beautiful Pulitzer trophy, and several arranged by the cities in charge. The Pulitzer trophy was donated by Ralph Pulitzer, Joseph Pulitzer, Jr., and Herbert Pulitzer, and is awarded for one year in addition to a substantial cash prize. This is the event which will bring the premier airmen of the world together in the fastest flights of the age.

It is difficult for people who have never seen or come in contact with the mechanism of this international gathering to realize its magnitude. A multitude of details must be worked out months in advance in preparation for the three days of unrivaled sport.

This work has already been started by a large group of Dayton business men under the able direction of Mr. Patterson. Extensive plans have been laid out for holding the Races in a more thorough manner than any other city having the chance ever dared try.

Eighteen sub-committees have been appointed to work in conjunction with the Executive Committee of the Dayton chapter of the National Aeronautic Association. The Executive Committee is working under the personal direction of Mr. Patterson and is composed of the following prominent business and professional men of the city:

Fred Rike, C. F. Kettering, John C. Haswell, W. R. Creven, Walter Moore, G. W. Shroyer, Irvin G. Kumler, Col. Frank T. Huffman, Ezra Kuhns, George H. Mend, Maj. L. W. McIntosh, Maj. A. W. Robins, Claude E. Barnett, Mayor Frank B. Hale, John F. Ahlers, and H. W. Karr.

Mr. Patterson Tours Europe

As the first step in obtaining foreign entrants in the Races, Mr. Patterson will visit the leading countries of Europe next month. Sailing from New York on Feb. 16, he will make personal calls on many high officials of European nations with whom he is acquainted and extend invitations to their airmen.

Gen. Henri Gouraud, French military and diplomatic official at Washington, is one of Mr. Patterson's influential friends whose aid will be sought in getting foreign competition in the Races. The distinguished representative is believed to be favorable toward having the famous Sadi Lecointe participate if the necessary arrangements can be made in France.

Another friend of Mr. Patterson whom he will visit on the foreign tour is F. P. Lahm, American Representative of the Federated Aeronautic Internationale in Paris. Mr. Lahm has lived in Paris a number of years and is well thought of in French aeronautical circles.

$50,000 in Prize Money

An important development this year which is expected to attract more aviators than ever before is that of increasing the prize money nearly four times. The winners last year were rewarded with cash prizes totaling $13,500. It is planned this year to raise the amount to $50,000.

Predictions are current that more than 25,000 visitors will be attracted to the city for the Races and Convention of the National Aeronautic Association which will be held in conjunction. This will necessitate the use of all available housing facilities and probably result in extra trains being run directly from the field to nearby cities.

Arrangements for underwriting $100,000 necessary to finance the Races have been completed. Other affairs to be considered will be taken up at headquarters for the 1924 Pulitzer Races, which will be established in the Realty Building on North Main Street.

There are hangars in Dayton for several hundred airplanes which will insure sky visitors of adequate shelter for their craft during the Races. The Race site, which was bought from funds raised nearly overnight in a campaign that will glow in tribute to the generosity and patriotism of Dayton's citizens, is excellently drained, of vast proportions and surrounded by open expanses. It contains all the features of an ideal airport.

The Aeronautical Experts

A committee of aeronautical experts selected Dayton for the Races. These men were guided in their judgment by B. Russell Shaw, executive of the Contest Committee, who has had wide experience in handling the events.

In choosing the Dayton aviation field, a careful and exacting survey was made of facilities here and of those at Minneapolis and St. Paul which were bidding jointly for the honors. The decision reached by the Contest Committee was unanimous.

The Dayton chapter of the National Aeronautic Association is the youngest in the United States and more than four times larger than any other. Frederick B. Patterson is president, Orville Wright, honorary president, and Charles H. Paul, first vice president.

Expert Opinion

The loss of the Dixmude has given rise to many and varied speculations as to the probable cause of its disappearance. The N. Y. *Tribune's* Paris correspondent, after recording that an Italian steamship watched "the big air schooner" being driven at a speed estimated at 120 mi./hr. before the storm, offers the following gem:

"Experts agree that a sixty-ton airship, such as the Dixmude, would be unable long to sustain such terrific exterior pressure without exploding in the air or diving headlong into the sea, in either case it would have been dragged down rapidly by the weight of its heavy motors."

It is deplorable to note that one hundred and forty years after the invention of the free balloon and after twenty years of power flight there are still newspapermen who do not seem to know that the wind does not exert the slightest "pressure" upon an airship with the motors stopped, when it merely drifts with the wind like a free balloon.

The Air Appropriations in the 1924-25 Budget

$27,435,000 Recommended for Army and Navy Air Services—Need Twice that Amount

Air appropriations included in the budget for the fiscal year ending June 30, 1925, are slightly in excess over recommendations for the fiscal year ending June 30, 1924, but in each case are not truly indicative of the very favorable outlook.

Following the Lassiter Board's report, based upon investigations made by Assistant Secretary of War Davis and his predecessor, Colonel Wainwright, now Congressman-elect, the War Department acted upon the Board's recommendation that a ten year program providing for $25,000,000 a year be set up for the Air Service.

The Present Situation

At the same time, the Navy Department, alive to the necessities of Marine defenses prepared a five year development program. The situation is set forth clearly, and apparently correctly, in the following Washington dispatch to the New York *Herald*, dated Dec. 12:

"The War and Navy Departments are preparing to launch a joint assault on the Bureau of the Budget to obtain modification of the allowances made for the Air Services of the Army and Navy.

"It is purposed to put the Air Services on a definite basis covering years and calling for definite allowances annually to carry out the program. A probable ten year period will be selected and full provision embodies as to material and personnel, so that the country will know ahead its air strength at any one point, in the period covered by the program.

"Much more serious than the need for replacement of obsolete material is the question of putting the country on a producing basis. At the moment factory conditions are regarded as deplorable for the reason that their maintenance has depended on Government orders which were not forthcoming because of the lack of appropriations and there were no commercial contracts of importance.

"At the basis of any workable scheme the board believes is the factor of industrial mobilization. This can only be accomplished by giving the factories a definite program to work on from year to year. To accomplish this the Army and Navy figured on $25,000,000 apiece. This total of $50,000,000 will not be given, but a drive to secure $40,000,000 is thought certain, particularly in view of the stress placed by President Coolidge on the importance of the Air Service in the scheme of the national defense."

Air Service Budget

The total amount of Budget for Air Service, 1925, is $12,435,000, an increase over 1924 of $9,000. Of this amount, there is specified for the purchase of aircraft, engines, etc., $2,854,700, the same amount as that provided for 1924. Of the money appropriated for aircraft and engine construction in the fiscal year ending June 30, 1922, there remains an unexpended balance of $2,399,001.65. The new bill makes this balance available until June 30, 1925, the $399,001.65 for payments on existing contracts and the $1,000,000 for new construction. There is thus available for the purchase of new aircraft and engines during the fiscal year 1925, $3,854,700.

For experimental and development work, including helium gas, $1,125,000 is appropriated.

Two other items of interest in the budget are $50,000 for the round-the-world flight and the provision "That none of the funds appropriated under this title shall be used for the purpose of giving exhibition flights to the public other than those under the control and direction of the War Department, and if such flights are given by Army personnel upon other than Government fields, a bond of indemnity, in such sum as the Secretary of War may require, for damages to person or property, shall be furnished the Government by the parties securing the exhibition."

Naval Aviation Budget

The total budget for the Bureau of Aeronautics, Navy Department, for the fiscal year ending June 30, 1925, is $15,000,000, an increase of $352,826 over 1924.

The amount in 1925 for new construction and procurement of aircraft and equipment is $5,264,826, a decrease from 1924 of $534,124. The amount in 1925 for maintenance, repair, and operation of aircraft factory, helium plant, air stations, fleet activities, testing laboratories, is $6,716,950, an increase over 1924 of $426,950.

The 1924-25 Budget of Naval Aviation is itemized below together with the corresponding sums appropriated the previous fiscal year:

	Estimate 1924-25	*Appropriated 1923-24*
For navigations photographic aerological, radio and miscellaneous equipment including repairs thereto	$ 325 000	$ 275,000
For maintenance repair and operation of aircraft factory, helium plant air stations, fleet activities, testing laboratories	6 716,950	6 290 000
For continuing experiments and development work on all types of aircraft	1 573 224	1 573 224
For drafting clerical inspection, and messenger service	710,000	710,050
For new construction and procurement of aircraft and equipment	5 264 826	5,798 850
For new construction, buildings, and improvements at air stations	410,000	0
Total	$15,000,000	$14 647 174

A Self-Winding Electric Clock

For the last ten years inventors and clock manufacturers have been trying to produce a practical electric clock which would be independent of an electric master clock and wind itself constantly from an electric current. The one thing which had to be obtained and which seemed to cause all the trouble, was the right relation between the magnetic winding device and the movements of the clock.

The Antimeter is an electric clock which has been designed to overcome these difficulties. It is the result of about eight years' experimenting. The original design worked well from the start and the experimental work has been to attain perfect time, durability to withstand shocks and vibration and adaptability to uses in various commercial fields. This clock only weighs 9 oz. and consists of two distinct parts, one the clock movement, and the other the winding device.

The movement of the clock is an ordinary movement built with a special five turn spiral spring for the driving spring. All spindles have extra heavy points and bearings, preventing breakage by shock or by vibration which makes the clock most suitable for the automotive field.

The magnetic winding device consists of a small electric magnet and is operated by a quick breaking switch. The intantaneous power of the electric magnet is transmitted through an ingenious ratchet to the spiral spring of the movement. This magnetic winding device is compact and built of such materials as will also withstand vibration and shocks. The power consumption varies on two types of clocks. The one that is operated from a 6 volt battery requires 1/25 of an ampere. Another model used for home, office etc., which gets its power from the electric lighting system (110 and 220 volts), requires so little power that it is practically impossible to measure it.

Because of the material and the sturdy clock construction, this electric clock is reported to stand up better under vibration and atmospheric changes than any hand wound clock. Tests are now being made at McCook Field and by the Naval Bureau of Aeronautics at Washington, to prove the feasibility of adopting this as an aircraft instrument.

France Develops Multi-Motored Transport Planes

Three Four-Engined Planes Cover 1900 Miles Across Country In Remarkable Competition

By LADISLAS D'ORCY

With a view to developing multi-engined airplanes specially designed to answer the requirements of long distance air transport, the French air department instituted in the fall of 1922 a competition restricted to French manufacturers. Full particulars of this interesting competition, which was held last September, have only recently become available and they are set forth below in some detail, to show the trend of commercial airplane development in France and the generous financial assistance French manufacturers are receiving from their government.

The total prize money with which the air department endowed this "Air Transport Grand Prize," as it was called, amounted to 1,000,000 francs, in addition to which the Aero Club of France was granted a sum of 100,000 francs for organization expenses. This is the largest amount of money any aircraft competition has ever been endowed with.

However, considering the great expense of producing machines answering regulations so difficult as those called for by the French air department, it was only fair that competing manufacturers should be assured of being adequately rewarded for their labors, if successful.

The regulations of this competition may at first sight appear unduly severe, but evidently the French air department sought to stimulate development well in advance of the present, somewhat restricted, needs of public air transport. For this reason, also, contestants were given a full year in which to perfect their designs.

Principal Requirements

The capital points of the condition for entry were as follows: First of all, the competing machines must be fitted with more than two engines, each of these being totally self-contained in respect of fuel systems, propellers, etc. No limit was placed on the total horsepower, or the gross weight of the plane, or the wing loading. Instead there was specified a minimum cargo or pay load of 1320 lb, representing six passengers at 176 lb each, with hand baggage at 44 lb each, in addition to a crew of three, and rather elaborate equipment for navigation by compass ("direct course flight") and night flying.

The commercial merit of the entries was determined, after the usual static tests of the air department, and some extremely arduous elimination flying trials, by a series of cross country flights in which the ships were given points for cargo carrying capacity, commercial speed and fuel consumption.

Each contestant declared prior to the static tests the weight of fuel he would carry. The plane was thereupon tested for airworthiness allowing for this fixed fuel load, which the machine must carry both in the elimination and the qualification trials, and which could not be exceeded in refueling the machine during the trials. However, with a view to additional safety, the contestants were authorized to carry on board a certain amount of emergency fuel in sealed containers, but its use eliminated the contestant from the competition.

Provisions for Equipment

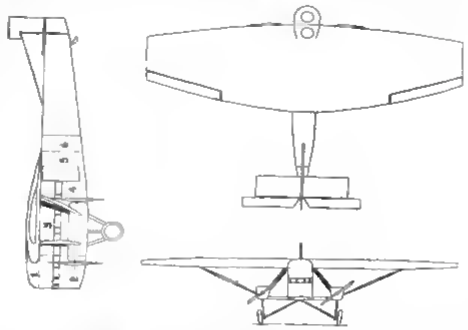
Elaborate regulations governed the equipment of the competing planes. The control cockpit must have seats and complete instrument boards for two pilots, with provision for locking either control sets from the opposite seat. The instruments must include compass, altimeter, clock, air speed indicator, turn indicator and inclinometer. From this cockpit the pilots must clearly see the entire runway of an airdrome at a minimum distance of 150 ft. ahead of the ship.

For the navigator a separate cabin or post must be provided and this must be equipped with checking compass, altimeter, clock, drift indicator and chart table. The navigator must be enabled to see vertically downward through an opening giving a 60 deg. cone of vision, and to take bearings at an angle of 60 deg. with the horizon and in a 160 deg. azimuth. The plane also must have a separate and enclosed radio cabin, 6 ft. by 5½ ft. by 5 ft. The weight of the radio apparatus is counted at 264 lb. in which is included the weight of the dynamo or battery for the lighting equipment. The plane must carry the lights provided by the International Air Convention, and also night flying lights, including a searchlight. Provision must be made for heating the cabin, but this equipment need not be installed, and the weight of the heating apparatus will be considered included in the passenger and baggage weights.

Access to, and communication between, the various stations, (control cockpit, navigation and radio cabins, and the passenger cabin) must be easy. The passenger cabin must be 5 ft. wide and have on each side a sliding door 52 in. high and 24 in. wide, and on the roof an emergency exit, 24 in. square. The passenger seats must be 20 in. wide. The baggage hold must be capable of containing as many suitcases as there are passenger seats, the maximum dimensions allowed for the suitcase being 24 in. by 16 in. by 6 in.

The Entries

Eight entries were received for this competition, two each from Blériot and Farman, and one each from Bnseaylet-de Monge, Breguet, Caudron and Potez. Three of these, one of the Blériot's, the Bnseaylet and the Caudron, were withdrawn on the grounds that it was impossible to complete them in time for the competition. As a matter of fact, only one entry, the Farman monoplane, passed the static tests on Aug. 17 as provided in the regulations, so that strictly speaking it alone was qualified for the subsequent trials. However, as Farman



Outline drawings of the Farman F3X transport plane—1, control cockpit; 2, navigation room; 3, passenger cabin, 4, radio room; 5, washroom, 6, baggage hold

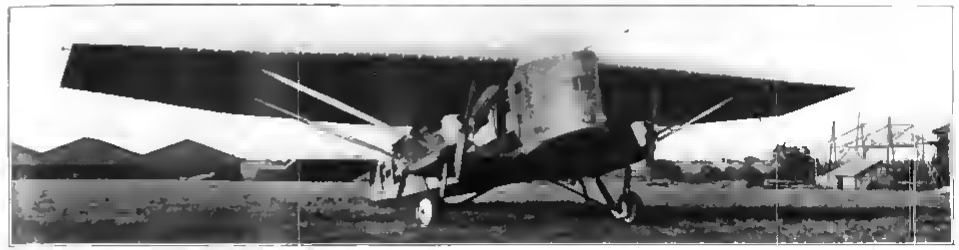
then withdrew this ship, the Aero Club of France was able to save the Grand Prize by annulling it and substituting for it one in which no date was set for the static tests.

Thus the ships which had not been withdrawn, though they were not ready for the static tests, were authorized to take part in the modified competition. This ruling elicited a protest from one of the competitors, M. Caudron, who had been so unwise as to admit that his ship was not ready in time.

The list of the contesting airplanes was as follows:

1. Farman type 3X, four-engined monoplane (Pilots, Coupet and Landry).
2. Farman type 4S, four-engined biplane (Pilots, Bossoutrot and Drouhin).
3. Blériot type 115, four-engined biplane (Pilots, Bizot and Villechanoux).
4. Bréguet type 22, four-engined biplane (Pilots, Thierry and Lemaître).
5. Potez type 22, three-engined biplane (Pilots, Labouchère and Favrean).

With the exception of the Farman monoplane, which was specially built for the competition, and embodied some extremely novel and original constructional features, the ships of the Grand Prize were all adaptations of already existing models.



The Farman F3X (four 180 hp. Hispano-Suiza engines) which won the French Air Transport Grand Prize competition for multi-motored cabin planes. Pilots: Coupet and Landry.

The Farman Monoplane

As may be seen with reference to the accompanying photographs and outline drawings, the Farman F3X is what is commonly and rather incorrectly termed a semi-cantilever monoplane. Its principal characteristics are as follows:

CHARACTERISTICS OF FARMAN F3X MONOPLANE

Total horsepower, 720	Weight empty, 6 600 lb
Engines, 4 Hispano-Suiza.	Weight loaded, 11 000 lb
Span, 85 ft.	Max. speed, 115 mi./hr.
Overall length, 48 ft.	Cruising range, 3 hr.
Height, 14 ft. 6 in.	Passenger seats, 10
Wing area, 674 sq. ft.	No. of crew, 3

Although the constructional features of this ship are in general those of the Goliath passenger-carrier, in the matter of design the F3X discloses a large number of highly novel and unusual points. Chief among these is the extraordinarily low aspect ratio of the wings and the roughly elliptical form of the latter—features which were both incorporated on the two senter sport plane exhibited by Farman at the last Paris aero show. At the time this design aroused much speculation, though it was generally considered as an exhibition freak. The remarkable performance of the big transport monoplane in the Grand Prize seems to indicate, on the contrary, that there is some genuine merit in this design which departs so radically from well beaten paths.

The main wing of the F3X is a single unit of wood construction, fabric covered, which is built up of plywood ribs on two box spars and on a false spar, which is located near the trailing edge to take care of the twisting stresses produced by aileron action. The wing decreases in chord from the center section, where it is 20 ft. to 10 ft. at the wing tips, which gives a mean aspect ratio of only 4.3. In thickness the wing measures uniformly 26 in. from the center section to the points where the wing bracing struts are joined to the main spars, whence the wing tapers down to 12 in. thickness at the tips.

The ailerons are of the non-balanced type, and are mounted at an angle with the transverse axis of the machine so as to get the maximum effect in control.

The main wing is fixed to the top longerons of the fuselage by means of steel fittings, and is further braced to the wing roots which protrude from the bottom of the fuselage by means of faired tubular steel struts. The actual overhang of each half-wing is about 11½ ft. The two rear V struts are staggered with respect to the front struts in order to brace the wing against drift, for there is no external wire bracing whatever in this ship.

The wing roots serve the threefold purpose of acting as engine bases, of enabling a mechanic to effect minor engine repairs in flight, and, lastly, of adding to the lifting area.

The fuselage is of the four longeron type, with plywood bulkheads and veneer plating. It is of square cross section, having a maximum height, at the cabin, of 9 ft. and a width of 5 ft. The internal arrangements comprise, walking aft from the nose: first, a navigation room; second, two control cockpits in tandem, high up and ahead of the wings, where the pilots are afforded excellent visibility; third, a spacious passenger cabin equipped with ten seats in two tiers; fourth, a radio room, followed by a toilet and a baggage hold. It should be noted that in the Grand Prize this ship only carried the equivalent load of eight passengers because of the numerous extra gadgets required by the regulations.

The tail unit is typical of modern Farman construction, all the control surfaces having square angles to simplify—and reduce the cost of—construction. The horizontal stabilizer measures 17 ft. by 4 ft. 6 in., the elevator, 23 ft. by 2 ft. 5 in., and the rudder, 10 ft. by 2 ft. 6 in. not counting the small balanced portion. A noteworthy point in this empennage is the simple yet effective manner of balancing the elevator by giving it a greater span than the stabilizer. A tail skid, hinged at the extreme end of the fuselage, protects the empennage from contact with the ground.

The power plant consists of four 180 hp. Hispano Suiza engines (120 mm. bore, 130 mm. stroke, 11.8 liters cylinder capacity), which are mounted in pairs, end to end, on the wing roots, being enclosed in streamlined nacelles from which only the cylinder heads protrude. The engines drive tandem propellers, there being two tractors and two pushers. Cooling of the engines is insured by Lamblin radiators of the 1924 model, which have the form of a strut. They are mounted on the inner wing bracing struts. Each engine has its separate pressure fuel system, the four tanks being mounted in the wings. Oil radiators are fixed under the engine cowlings.

The landing gear is remarkable for its large tread, 15½ ft., and consists of two 3 ft. wheels which are rubber sprung in welded steel struts of V form. These struts are attached to the wing roots under the engine nacelles, and are braced laterally by two steel tubes which abut on the bottom of the fuselage in a ball-and-socket joint.

According to *Les Ailes*, the F3X is, in its present form, still considered as an experimental machine, which will be modified to some extent before it will be placed in service on the airways. It is proposed to substitute two engines of higher power for the four engines now used, in order to obtain a better performance. This would permit of decreasing the height of the landing gear. The performance could also be improved by decreasing the height of the fuselage, which was built to satisfy the requirements of the Grand Prize.

The Improved Goliath

The other Farman entry, type F4S, is a modified Goliath, in which four engines with tandem propellers have been substituted for the two engines of the standard ship of this type. The structure has also been generally reinforced to take care of the greater load carried. The main characteristics of this ship are as follows

CHARACTERISTICS OF THE FARMAN F4S BIPLANE

Total Horsepower, 1040	Weight empty, 7084 lb.
Engines, 4 Salmson	Fuel load, 2268 lb
Span, 94 ft. 2 in.	Weight loaded, 13,000 lb
Overall length 48 ft. 0 in	Passenger seats 18
Wing area, 1501 sq ft.	No of crew 3

Although this ship has seats for eighteen passengers, it was only credited in the competition with a pay load of 1760 lb., corresponding to eight passengers and baggage This discrepancy was due to the large amount of special equipment carried on board.

This machine won the second prize in the Grand Prize.

The Bleriot Type 115

This ship, which secured third place in the Grand Prize, is a four engined biplane in which the engines are mounted on the leading edge of the upper and lower wings so that all drive tractor screws. The accompanying illustration shows well this so-called "quadrilateral" engine mounting, which was first used by the Blériot firm on the "Mammouth," produced late in 1920 Its trials were not a success, whereupon Blériot produced for the 1921 Paris aero show a four-engined transport plane with tandem screws. It is understood that this second multi-engined ship was no more successful than the first named, and last year a third type was produced, in which the original quadrilateral engine mounting was again resorted to Save for some minor changes, introduced since, this ship was the type 115 which participated in the Grand Prize

In view of the tenacity with which the Blériot Co has pursued the realization of the quadrilateral engine mounting, it is interesting to learn the idea back of it

Granting the operational difficulties of twin engined planes, says *L'Air*, if we equip a plane with three engines, we have the same disadvantage as in single-engined ships, namely, that of having one engine in the fuselage, whence noise, heat and oil fumes penetrate into the passenger cabin Hence, it is only with a minimum of four engines that the problems of safety and comfort can satisfactorily be solved But with four motors the twin tandem arrangement results in an inefficient utilization of horsepower, while the "in-line" arrangement—such as on the Zeppelin-Staaken monoplane—introduces great moments of inertia, which may become dangerous should one of the onter engines fail.

With the Blériot "square" engine mounting, which has now been developed into the better "trapeze" mounting—the top engines being spaced wider than the bottom ones—it is claimed that the drawbacks of the four-engined power plants are mostly overcome, inasmuch as the propeller axes are spaced very closely, and failure of one engine would but little affect the stability of the ship.

The remarkable performance of the Blériot 115 in the Grand Prize, where it "lost" one of its engines in a cross country flight, in very gusty weather, and completed the trip on three engines, would seem to justify these views.

The chief characteristics of this ship are as follows:

CHARACTERISTICS OF BLERIOT 113 AIRPLANE

Total horsepower 720	Weight empty, 6,380 lb.
Engines, 4 Hispano-Suiza	Weight loaded 10,340 lb.
Span 82 ft. 4 in	Fuel load 1813 lb.
Overall length, 47 ft. 0 in	Passenger seats, 6.
Wing Area, 1360 sq ft.	No of crew, 3

Although equipped to carry eight passengers, this ship only carried six of them in the competition.

Constructionally the Blériot 115 is of fairly orthodox lines, the wings being built around wooden box spars and plywood ribs, while the fuselage is of the four longeron type, with plywood bulkheads amidships and wire braced aft.

The Breguet Leviathan

The Bréguet type 22, or modified Leviathan, was described in these columns in connection with the last Paris aero show It will be remembered that in its original form the Leviathan had a central engine room with four Bréguet-Bugatti motors driving a single tractor propeller through an ingenious though somewhat complicated gearing system, in which provision was made for the automatic disengaging of an engine that would not "rev up" sufficiently. Despite its ingenuity and its undoubted success as far as operation of the power plant was concerned, this system was discarded because it took up too much space in the fuselage, and instead tandem wing engines were substituted in a later model

The main feature in the construction of this ship is the almost exclusive use of duralumin tubes and stampings in all structural members The wing spars are tubes, the ribs are stampings, and the fuselage is built up of duralumin strips of channel and corner sections, riveted together. The wings are fabric covered, however.

In the Grand Prize the Leviathan was credited with a pay load of twelve passengers.

The main characteristics of the Bréguet type 22 are as follows.—

CHARACTERISTICS OF THE BREGUET TYPE 22 AIRPLANE

Total horsepower 1020.	Weight empty, 7620 lb
Engines, 4 Lorraine	Fuel load 2,530 lb
Span 94 ft.	Weight loaded, 14,310 lb
Overall length, 45 ft	Passenger seats 18
Wing Area, 1480 sq. ft.	No of crew, 3

Potez Three Engined Plane

The Potez type 22 is a more hasvily engined version of the three-motored passenger carrier, type 17, which was exhibited at the last Paris aero show, and was described here in that connection The three 270 hp Lorraine-Dietrich engines of type 17 have been replaced in type 22 by three Jupiter engines built in France under Bristol license by the Gnôme-Rhône Co This engine is rated 450 hp. in England, and 380 hp. in France.

The principal characteristics of the Potez type 22 are as follows:

CHARACTERISTICS OF POTEZ TYPE 22 AIRPLANE

Total horsepower, 1140	Weight empty, 6 320 lb
Engines, 4 Jupiters.	Weight loaded, 11,23n lb
Span, 72 ft. 7 in	Max. speed 120 mi./hr
Length 52 ft. 9 in	Passenger seats, 3
Wing Area, 1210 sq. ft	No. of crew, 3

The ship is an externally braced biplane of fairly orthodox lines and composite construction. The wings, of rather thin section have wooden box spars and plywood ribs, and are fabric covered. The interplane struts are streamlined duralumin tubes. The ailerons are of the balanced type. The fuselage is of square cross section, wooden longerons and plywood bulkheads being used in the construction of the cabin, while angle section duralumin members, riveted together, form the rear portion of the fuselage. The cabin is veneer covered, while fabric covering is used on the metal portion of the fuselage. The cabin is 26 ft. long, 5 ft. wide and 6 ft. high, and is equipped with eight passenger seats, although in the Grand Prize only the equivalent of six passengers was carried.

The engines are all arranged for tractor propellers. The central engine is mounted on a steel plate in the nose of the machine, while the two remaining Jupiters are carried between the wings in V struts. All the engines are fully exposed to the air stream, which may be necessary for efficient cooling, though it produces much parasitic resistance. A Bristol auxiliary engine, fixed in the fuselage, serves to start the main power plant.

The landing gear is of the four wheel "in-line" type made famous in this country by the original Martin Bomber.

The tail unit is chiefly remarkable for the use of two compensating reddets, mounted on either side of the maneuvering rudder, which can be set at a given angle to offset the turning tendency of the ship when one of the wing engines is out of action.

The Farman F4S (four 268 hp Salmson engines) which finished second in the French Air Transport Grand Prize competition Pilots: Besseutrot and Drouhin

Photo Kadel & Herbert

The Blerint madel 115 (four 180 hp. Hispann-Suiza engines) which secured third place in the French Air Transport Grand Prize competition. Pilots: Bizot and Villechanoux

Rules of Elimination Trials

The elimination trials comprised the following performances:

(1) Take off and landing with a "ground run" not to exceed 825 ft.

(2) A flight of 15 min. duration up to an altitude of 6500 ft. with one of the engines stopped, without the other engines exceeding their normal rated horsepower.

(3) Each of the engines must be stopped and started again while the ship describes in flight figure eights, without the figures exceeding 2 min. in duration, each. The plane must describe as many figure eights as there are engines on board

(4) Two spark plugs to be changed in flight on two different engines designated beforehand by the judges' committee. The engines may be stopped for the purpose of this test, but in this case they must be re-started before the plane lands.

All these performances could be made in a single flight, or in separate flights, and in two days.

Elimination Trials

The elimination trials were scheduled for Sept. 17 and 18. On the first day, low hanging clouds prompted the judges to reduce the height prescribed for the 15 min flights with one motor stopped from 6600 ft to 3300 ft. Even so, the visibility was so poor that the Blériot 115 which accomplished all the elimination trials this day, had its performance disallowed by the judges. Both Farmans attempted the trials, but only the Goliath was fully qualified, the Farman monoplane failing to take off and land within the stipulated 825 ft The Bréguet was not yet ready, while the Potez had engine trouble.

On Sept. 18 the weather was so bad that the judges postponed the trials to the following day, when the Farman monoplane completed its elimination trials and the Blériot was qualified by repeating them to the satisfaction of the judges. The latter ship took off with its full load in 360 ft. The Bréguet, carrying 2640 lb of cargo, then took off for the trials. After making the altitude flight with one motor stopped, and the figure eights requiring the successive stopping and starting of all engines in flight, the ship proceeded to make the most difficult of the tests, that of changing in flight a spark plug on two of its engines. One "resparking" had successfully been accomplished, but when the turn of the rear starboard motor came, it failed to start again. Nevertheless, the pilot "hung on" in the hope of completing all the trials in a single flight, when the front starboard motor began missing and the ship stalled and side slipped from 30 ft. to the ground. The landing gear was demolished, but though the ship was not badly damaged, one of the gasoline tanks burst and caught fire before the motors could be cut. The crew promptly scrambled out, uninjured, and before the fire could be put out the Leviathan was a seething mass of flames, fed by 400 gal. of gasoline, which completely destroyed the ship in a few minutes.

While this was happening, the Potez made all the elimination trials, but the performance was disallowed, for in making

the figure eights the maximum time allowed was exceeded by 30 sec., and furthermore these flights were made at an altitude of 5000 ft. The judges thought that this altitude was too high to permit of adequately checking the performances from the ground, although it was witnessed by a "control plane" which kept close to the contestants in all their evolutions.

Rules of Qualification Trials

The qualification trials of the Grand Prize consisted of a triangular flight of 536 mi. length, Paris-Calais-Metz-Paris, with an obligatory stop at Metz, and of four return trips of 334 mi. length each, Paris-Metz-Paris, in which stops for refueling were authorized at Le Bourget, the airport of Paris. Emergency landings en route were also allowed, but the time so employed was not neutralized, nor was that of the authorized stops at Le Bourget. Replacement of engines was antharized. The total length of these cross country flights was 1880 mi.

Although French accounts of the competition are not specific on this point, it appears that it was originally intended to carry out all of the qualification flights in succession, which would have involved night flying for part of the time. This would explain the provision in the regulations that the night flying equipment is "expected to function." However, owing to the stormy weather on the first day of the qualification trials it was decided to forego the night flying feature and to hold these trials on three separate days, the triangular flight coming first, and being followed for two days by two return trips between Paris and Metz.

The purpose of these flights was to demonstrate the value of large cargo carrying capacity, high commercial speed and low fuel consumption in commercial operation. To prevent any of these commercial factors from being given paramount importance at the expense of the other two, the qualification was determined by a "figure of merit" F, as follows:

$$F = \frac{P \times V}{C}$$

where P is the weight of the cargo, V the commercial speed and C the weight of the fuel consumed in the qualification trials.

The minimum cargo allowed was, as said before, six passenger baggage units of 220 lb. each, and additional cargo capacity was only recognized in 220 lb. units.

The commercial speed V in the figure of merit was based on the time elapsed between the scheduled start and the time when the machine, having landed, was refueled and considered by the officials as being ready to resume flight. No time allowance was made for refueling stops or for emergency landings—both of which were authorized—so that the so-called commercial speed actually represented the time elapsed while flying from airdrome to airdrome plus the time required for refueling at the conclusion of each complete circuit. This unusual ruling was obviously made closely to simulate commercial operating conditions, though it is not apparent why the time spent in refueling a machine *after* completion of a flight should be held against it in computing its commercial speed. The official time of start was announced one hour in advance, and failure to start within an hour of this time caused the contestant to be disqualified. The engines must be started from the cockpit without any external assistance. Commercial speed, as above computed, which fell below 68 mi./hr. was penalized by a proportionate reduction in the prize money.

Qualification Trials

Rain storms and low visibility caused the postponement of the qualification trials until Sept. 22. On that day, though a 25 mi. wind was blowing, the two Farmans and the Blériot were given the start for the 536 mi. circuit, Paris-Calais-Metz-Paris. Landing was prohibited at Calais and compulsory at Metz. Visibility was poor, and weather conditions all along the circuit were reported to be bad.

The starts to schedule came off remarkably well, considering the number of engines that made up the power plants of the competing ships. The time elapsed between the scheduled and the actual start was 35 sec. for the Farman monoplane, 71 sec. for the Goliath, and 3 min. 55 sec. for the Blériot.

Although a regular storm developed as the day advanced, the three ships all completed the circuit at altitudes varying from 150 ft. to 1000 ft. An idea of the weather conditions may be had from the fact that the Blériot flew the last lap of the circuit, from Metz to Paris, entirely by compass readings, being all the while out of sight of the ground. The performances on this day are tabulated below:

Ship	*Hp*	*Cargo (lb.)*	*Comml Speed (mi./hr.)*
Farman Mono	720	1760	87 58
Goliath	1040	1760	71 62
Blériot	720	1320	83 00

Sunday, Sept. 23, the start was given for the second series of cross country flights, namely two return trips between Paris and Metz, making a total distance of 668 mi. The difference between the scheduled and the actual starts for the three ships was as follows: Farman monoplane, 4 min. 28 sec., Goliath, 6 min. 28 sec.; Blériot, 5 min.

The weather being somewhat better than on the previous day, though the air was still very gusty, all the ships made better time. All finished the two return trips as scheduled, though the Blériot had the misfortune of having its top starboard engine quit on the last lap of the second flight, which compelled it to fly from Epernay to Paris—a distance of 70 mi.—on three engines only. On landing it was found that the bottom starboard engine had been badly overworked due to the failure of the top engine, and so it was replaced. The time required to do this, about 3 hr., counted in the official landing time, which explains the low commercial speed with which the Blériot was credited that day. The table below gives the commercial speed for the two days (1204 mi.):

Ship	*Hp*	*Cargo (lb.)*	*Comml Speed (mi./hr.)*
Farman Mono	720	1760	73 34
Goliath	1040	1760	75 82
Blériot	720	1320	50 22

Sept. 24 saw the final trials of the competition. These were a repetition of the flights of the previous day, that is, two return trips between Paris and Metz, a total of 668 mi. The weather was much better and the pilots had uneventful trips, save that due to engine trouble the Blériot lost about 2 hr. at Paris before starting the second flight. The Farman monoplane started within 6 min. 29 sec. of the scheduled start, the Goliath within 5 min., and the Blériot within 8 min. 56 sec. The final results are tabulated below:

FINAL RESULTS OF FRENCH AIR TRANSPORT GRAND PRIZE

	Farman M	*Goliath*	*Blériot*
Horsepower	720	1040	720
Cargo (lb.)	1760	1760	1320
Comml speed (*mi./hr.*)	76 5	78 5	62 4
Gasoline cons. (lb.)	7064 2	9411 6	7012 2
Oil cons. (lb.)	283 8	574 2	593 6
Total fuel cons. (lb.)	7348 0	9985 8	7672 8
Figure of merit	23 69	22 30	15 38

Conclusions

This tabulation shows that the Farman monoplane had the highest figure of merit, followed by the Goliath, the Blériot coming third. This will be readily understood, considering that the big monoplane carried the same cargo as the Goliath at almost the same speed but with 25 per cent less fuel consumption. Also, the monoplane consumed for the same horsepower 15 per cent less fuel than the Blériot, though the latter carried 440 lb. less cargo. The commercial speed of the latter, as given in the above table, is somewhat misleading, as the Blériot suffered repeatedly from engine trouble. If we deduct the total time required for refueling and engine repairs we obtain the following commercial speeds: Farman monoplane, 83 3 mi./hr., Goliath, 83.5 mi./hr., Blériot, 81 8 mi./hr. According to the French data sheets, these speeds were obtained with the following power output of the engines: 140 hp. from the 180 hp. Hispanos of the Farman monoplane, 190 hp. from the 260 hp. Salmsons of the Goliath, and 145 hp. from the 180 hp. Hispanos of the Blériot.

The Farman monoplane won the first prize of 500,000 francs, the Goliath the second prize of 200,000 francs, and the third prize, 100,000 francs, went to the Blériot with a reduction of 30 per cent, due to its commercial speed falling below the minimum 68 mi./hr. stipulated.

Report of the Naval Arctic Air Board

Plan Calls for Use of Shenandoah, Six Planes, Mooring Masts and Two Airship Tenders

The report of the Naval Arctic Air Board was made public by the Secretary of the Navy on Dec. 26.

The plan calls for the use of the airship Shenandoah, two vessels with mooring masts for the Shenandoah and six planes. The Board recommends that the expedition start as early as practicable, probably in June. The plan is to send two vessels, with three planes each, one to Nome, Alaska, and the other to Spitzbergen, where preliminary flights for aerological observations will be made. When all is ready the Shenandoah will fly to Nome via mooring masts at Fort Worth, Tex.; San Diego, Calif.; Puget Sound and Nome; thence northward for the accomplishment of the mission of the expedition. The exploration of the North Pole area should include a systematic search of the unknown region north of Alaska, according to the report.

Details of Plan

The plan recommended by the board depends on distances to be covered and weather conditions. Specifically these are as follows:

DISTANCES

(a) Lakehurst to Fort Worth	1191 naut. mi.
(b) Fort Worth to San Diego	1003 naut. mi.
(c) San Diego to Puget Sound	1200 naut. mi.
(d) Puget Sound to Nome via Seward and west coast of Alaska	1944 naut. mi.
(e) Nome to Barrow via C.P.W.	526 naut. mi.
(f) Nome to Pole via Cape Prince of Wales	1560 naut. mi.
(g) Nome to Spitzbergen via Pole	2200 naut. mi.
(h) Point Barrow to Pole	1117 naut. mi.
(i) Nome to middle of unexplored area (82° N to 165 W)	1100 naut. mi.
(j) Nome to Teller	63 naut. mi.

CRUISING RADIUS OF THE SHENANDOAH

The radii given are based on the following conditions: using helium, no alteration of structure of bag, removal of one engine to convert space to living quarters, use of water recovery, reduction of ballast by 3300 lb., zero wind and with limited data now at hand.

2900 naut. mi. at 52 knots
3445 naut. mi. at 44 knots
4250 naut. mi. at 35 knots
} With a margin of 15% extra radius.

WEATHER CONDITIONS (APPROX. AVERAGE)

Place	*Month*	*Wind mi./hr*	*Temperature Fahrenheit*	*Earliest date accessible by ship*
Nome	June	6	45	First week in June
	July	7	51	
	Aug.	7	50	
Pt. Barrow	June	11	35	Aug. 1
	July	11	41	
	Aug.	15	39	
Spitzbergen (Green Bay)	June	7	45	June
	July	11	40	
	Aug.	11	39	

The above is the average weather conditions, but data before the Board shows occasional gales up to force seven.

SELECTION OF BASE

After detailed study of all possible bases the Board recommends that the northern base be situated in the Nome district for the following reasons: (a) Early accessibility (First week in June), (b) Proximity to unexplored area, (c) Proximity to U. S. Bases, (d) U. S. Territory, (e) Communications with south good, (f) Some local facilities.

The Board recommends two vessels equipped with mooring masts for the following reasons:

(a) Vessel at Nome Base may select a lee to which Shenandoah can come in case of bad weather at mooring mast at Nome Base, and use of this vessel may advance the time of the flight materially.

(b) Vessel at Nome Base can push on to edge of pack ice thus advancing the northern base.

(c) Vessel at Spitzbergen to provide a base in case the Shenandoah finds it desirable to continue to Spitzbergen through force of circumstances or to establish trans-polar air route.

As an anchor to windward in case of trouble to the Shenandoah, or in case the Pole cannot be reached the first summer, the Board proposes to establish a mooring mast at Point Barrow, which can be reached from Lakehurst by a direct flight of 2998 naut. mi. The Pole may be reached from Point Barrow with a good margin (1117 mi.) whereas the round trip from Nome to the Pole is problematical.

Equipment for a three point mooring should be taken to Point Barrow, and arrangements made with the Coast Guard to have the steamer Bear at Point Barrow with as many men from the Nome Base as can be berthed in her for the purpose of hauling the Shenandoah down for refueling.

It is further proposed to send a small advance aerological party to Seward or other point in Alaska as early as possible, and to have the ZR3 stand by at Lakehurst in reserve.

The Board considers that with all the ships, the Shenandoah and planes equipped as recommended and provided in ample time, the Arctic exploration is feasible and practicable during the summer of 1924 without undue risk to personnel or material.

The report is signed by Rear Admiral William A. Moffett, senior member; Comdr. William R. Furlong, Lt. Comdr. Ezra G. Allen, Lt. Comdr. Fitzhugh Green, Lt. Comdr. Robert A. Bartlett, Gilbert Grosvenor and Lt. Comdr. Harold T. Bartlett, members.

It received the approval of Secretary of the Navy Denby on Dec. 22, 1923, subject to such modifications as may be authorized later.

Admiral Moffett to Lead Expedition

On Jan. 10 Admiral Moffett was designated as commander of the Naval Arctic exploration party by Secretary Denby, with full control of the Shenandoah, the bases and ship and plane auxiliaries. It is understood that this will apply to the airship tender sent to Spitzbergen which will be used as a mooring mast and radio compass station, as well as to all operations conducted.

Whether the Admiral will actually fly in the Shenandoah is said to be up to him, but it is believed that he intends to take part in the northern flights to the Pole. His rating as a Naval Aviation Observer, which is virtually a flying rating, would qualify him to take part in the aeronautical venture as an active member of the ship's crew if it were necessary, some officials say.

Purposes of Expedition

A summary of the purposes and possible accomplishments of the expedition, given out by the Naval Arctic Air Board is reproduced below with minor omissions:—

"The purpose of naval exploration in the Arctic is to determine and chart the location of unexplored land in an area one-third the size of the United States. This 1,600,000 sq. mi. lying between Alaska and the North Pole.

"A single dash into such an area determines little. To know the area requires search and mapping by aerial photography in a systematic way. The work of the first summer could accomplish reconnaissance, the possible general location of some land, the proof of the feasibility of charting by the airship Shenandoah and by planes equipped for work on ice and water, and the establishment of bases with airship mooring masts from which the whole work could be continued in the future.

"If any land is located or if the charting proves that land does not exist then the United States has added that much to the scientific knowledge of the world. Furthermore the United States may through this work be the first to establish an air route from Western Europe to Japan over the top of the world.

"Both planes and the airship Shenandoah are necessary for this work. The Shenandoah will be used chiefly because of her greater cruising radius, but she has added advantages in ability to carry considerable photographic equipment, scientific instruments, and ability to hover over a spot to take observations of the sun for fixing locations of places on the earth's surface. The planes will be of use for shorter flights in the neighborhood of the northern operating base to secure aerological data.

The Northern Base

"In the selection of a northern base the vicinity of Nome offers the best site to an American expedition because of its early accessibility by steamship, the ice breaking up off Nome in the first week of June. It is near the unexplored area and at the same time within easy reach by radio of United States bases; it has some local facilities for landing the materials of masts and other equipment and it is in United States territory. Points in Greenland and Spitzbergen are much nearer the Pole than Nome, but since one summer month will be spent in establishing a base only two months of summer are left—July and August. It is necessary therefore to get a base where work can be done on the mooring mast in the month of June. At Nome the mean temperature over a number of years has been June 45 deg. F, July 51 deg. F, August 50 deg. F. Nome is 1560 naut. mi. from the Pole, or a round trip in straight flight of 3120 naut. mi.

"In order to explore the whole area this distance would dictate a more northern base. Pt. Barrow, the most northern point of Alaska, is 1117 naut. mi. from the Pole, but the ice conditions prevent Pt. Barrow being reached until the first of August, and then only by small vessels especially constructed for withstanding the force of ice jams and working through the broken ice. At Pt. Barrow there is no certainty of landing the structural materials and fuel for a complete base in a single season. This is because there is clear water off Pt. Barrow only for two or three weeks and in some seasons it has been known to last only for six hours.

At Pt. Barrow the mean temperatures over a number of years have been June 35 deg. F, July 41 deg. F., August 39 deg. F. It might be advisable to cache gasoline here for refueling. Two hundred people could hold the Shenandoah in a calm while this was done. If a mooring mast could be erected here in one season it would be of great use in succeeding seasons for securing the Shenandoah for refueling.

To Use Water Recovery

"When the mooring mast has been established at Nome and weather reports have been received, the Shenandoah will fly direct from Puget Sound to Nome, a distance of 1944 naut. mi. Previous to this the Shenandoah will have flown from Lakehurst, N. J., to Puget Sound, a distance of 2094 naut. mi.

"The use of gasoline fuel during the long flights necessary for exploring lightens the ship considerably. This means that she is too buoyant and would rise to altitudes not desirable, and that to come down helium would have to be "valved," to make her less buoyant. On the long flights to be made on this expedition this is serious and will be cared for by recovering enough water from the gasoline burned to make up for the loss of weight in gasoline. Even greater weight of water can be obtained by this process of "water recovery" than the original gasoline weighed. This is because, when gasoline burns, one of the products of combustion is hydrogen which, when combined with the oxygen of the air, gives water sufficient to replace the weight of gasoline lost as fuel.

"Although the winds for July and August average 7 mi./hr. at the Nome Base, the Shenandoah must be prepared for occasional gales that blow here as high as 60 mi./hr. during those months. To be able to meet adverse winds with a good margin of fuel is the chief reason for reducing the length of flights considerably below her full cruising radius in calm weather.

"A mooring mast for the Shenandoah built on a ship would serve to advance the base at Nome by the amount the ship is able to proceed to the northward from Nome as the ice clears. A ship large enough for this is not small enough to work through the ice as the wooden sealers and whalers do, but must wait for comparatively clear water. The ship with a mooring mast, in addition to reducing the length of trips of the Shenandoah by two or three hundred miles, also may prove valuable in being able to seek a lee where the force of the wind is much less than at the permanent Nome mast.

"Another ship fitted with a mooring mast and stationed at Spitzbergen would act as a still further aid in shortening the radius required of the Shenandoah, for, suppose that on exploration work in the neighboorhood of the North Pole, adverse winds are encountered on the return to Nome (1560 naut. mi. from the Pole), then the Shenandoah could continue on the Spitzbergen which is only 640 naut. mi. from the Pole. Spitzbergen was selected as a base for airships by Count Zeppelin as early as 1910. He went there with Prince Henry of Prussia and a staff of scientists and selected a low open valley as an admirable site for a airship base for North Polar work. The Germans kept a small party on aerological work there until 1914.

"For all this long distance work the Shenandoah must have good communication by radio. The demand has already been put upon radio engineers to double the radio transmitting distance from the Shenandoah, thus improving the ship's usefulness both as a naval scout over long sea reaches and improving one of her commercial needs. In addition she will be equipped with radio compass for taking bearings on radio transmitting stations in America and Europe and thus assist the navigators in locating her position in the polar region."

Belgian Aircraft Factory Busy

One of the points of the aerial reconstruction program adopted by the Belgian government after the war was the creation of a national aircraft factory capable of satisfying all the needs of the Belgian military air service. Prior to, and during the war, Belgium was entirely dependent for its aircraft equipment on foreign sources of supply. The drawbacks of this situation, considering the growing importance of air power, prompted the Belgian government to bring about the constitution of a privately operated aircraft factory over which the government exercises a certain amount of supervision.

The company which was created for this purpose, known as the S.A.B.C.A., erected a plant of some 60,000 sq. ft. floor area at Evère, near Brussels, where it employs 89 engineers and draftsmen, 13 foremen and 403 other employees. During 1922 the S.A.B.C.A. produced 43 complete airplanes, and it repaired 36 planes, 204 motors and 457 magnetos. At a lighter-than-air annex of the company, located at Kookelberg, two spherical balloons were built during this period. M. Demonty is chief engineer of the plant.

Under an agreement with the Belgian government the latter guaranteed the plant an annual production order of not less than 6,000,000 francs. On Jan. 1, 1923, the factory had orders for thirty Nieuport pursuit planes, fifteen Ansaldo observation planes and twenty four Avro training planes—all of which are being built under license from the respective manufacturers—and spare parts as well as the repairing of hundreds of motors. The factory is also licensee for the products of Blériot, Farman, Hanriot, Handley Page, DeHavilland and Sped.

The present capacity of the factory is two planes per day, and facilities are provided for a rapid expansion in time of war. The workmanship of the planes produced by the S.A.B.C.A. is said to compare very favorably with the best products of Europe. Steps are being taken to complete the manufacturing facilities of the factory by equipping it for the production of special aircraft materials, such as plywood, streamlined wires, cables, airplane and balloon fabrics, dope, etc.

Military Airplanes for China

The warring factions of China apparently appreciate the value of military airplanes, judging by press reports. Twelve bombing planes of French manufacture were recently delivered at Mukden, China, to the army of Chang Tso-Lin, provincial governor of Manchuria, while a consignment of American airplanes intended for military purposes has been received at Canton by the forces of Sun Yat-Sen.

The Duke of Sutherland's Impressions

America is Behind England in Commercial Air Transport, Says British Under-Secretary for Air

The Duke of Sutherland, Under Secretary of State for Air in the British Cabinet, before he sailed back to England, broadcasted from station WJZ of the Radio Corp. of America his impressions of American aviation. He was introduced to the public by the publisher of AVIATION, who pointed out that the Duke's interest in air transport was the natural result of his family's concern with earlier methods of transportation. The first Duke of Sutherland built four hundred miles of roads in Scotland when there was no other means of travel through that part of the country. The second Duke of Sutherland was interested in canal building, while others of his lineage had large holdings in British railroads.

Looking into the future, the present Duke of Sutherland sees the time close at hand when air transport will take its place with the older, established means of travel.

The visit of the Duke of Sutherland to this country has had an excellent effect on the aeronautical situation, for he was able, by his visit to President Coolidge, Secretary of State Hughes and other high government officials to convey to them in an authoritative way the progress that was being made by Great Britain in air navigation. The aircraft industry, too, learned much of the methods of the British government in dealing with constructors. It is to be hoped that more visits of a similar kind will be made in the future.

The radio address of the Duke follows:—

It is an interesting experience for me to broadcast a few words to you over the Radio. I had hardly landed on your hospitable shores when I was asked by the Radio Corporation to make a few remarks about aviation to their invisible audience. You are a very alert people, your newspaper men secure interviews even before steamers have put into port. It seems probable that visitors will soon be asked to broadcast their first impressions of New York from aboard ship almost before they have sighted that fine city. We also broadcast in Great Britain, but not yet on quite such a large scale as you do.

Air and the Great Trade Routes

The purpose of my visit to the United States has been to study your aeronautical progress, to exchange views on the prospective development of aviation generally and commercial aviation in particular, also, to establish personal contact with the heads of your Air Services, your Aircraft Industry and your pilots.

The United States and the British Empire more than any other countries should appreciate the value of flying—the United States because of the vast distances and great centers of population within a self-contained continent, and the British Empire because its strength lies in quick imperial inter-communication and the necessity for guarding in connection with the Navy the great trade routes between the Mother-Country and her widely scattered Dominions. Aviation ended Britain's insularity and she is now a continental nation; her effort is to develop commercial flying and at the same time to provide air defenses in proportion to the size and importance of her Empire.

My program here has been as complete as was possible in the limited time at my disposal, and I take this opportunity of once more expressing my feelings of gratitude to all those who have shown me such kindness and cordiality. I assure you my visit has been a great delight to me. At the inspections of your Air Service Fields I witnessed some remarkable flying performances: the daring and resourcefulness of your pilots is always a source of sporting admiration to us. At Lakehurst I had the pleasure of examining your new airship, the Shenandoah, and I congratulate you upon this fine masterpiece of American engineering. I believe much will be learned from its work in the polar regions next summer. The successful production of non-inflammable helium gas should also be of great advantage to the progress of your lighter-than-air undertakings. My visits to some of your aircraft factories were of particular interest: your aeronautical industry like ours, though young and struggling for existence, is producing some new types of airplanes, engines and equipment equal to anything in the world. In your Post Office Air Mail Service you have an admirable enterprise, and I shall not forget the businesslike methods of handling the mail planes that I have seen. I wish good luck to the proposed night mail services—a trans-continental air postal service in 30 hr. would indeed be a boon to the American people.

The British Air Lines

Though most praiseworthy individual efforts have been made to launch civil and commercial transport by air in this country, yet I feel that you are somewhat behind us in the branch, partly no doubt on account of the subsidies which the British government pays to operating firms, and partly owing to the assistance of our legislation and Air Navigation Laws. Rightly or wrongly, we believe in this policy for the purpose of fostering the growth of civil aviation at the start. Ultimately, when it is firmly established, it should become self-supporting.

In view of this, we have just started a large air transport company with about five million dollars capital to be raised privately, combining all British air lines from London to the Continent and over Europe, drawing a subsidy of about five million dollars from the government; this subsidy to be spread in instalments over the next ten years, after which time we believe the Company should be a profit-making concern. Sir Eric Geddes, the brother of our present Ambassador at Washington, has agreed to become chairman of this company. Our flying records in regard to the London-Paris service is not a bad one; the Handley-Page machines with Rolls-Royce engines which work this route have flown daily during the past two years without injuring a single passenger and on average they have had only one forced landing to every 25,000 mi. flown, or the equivalent distance of once round the world. Other lines such as the Instone and Daimler show similarly successful results. This, I think, proves that flying with proper precautions can be made even now almost as safe as the railway train or steamer.

Light Plane Development

With a view to popularizing aviation in England, we are building light airplanes of 10 to 20 hp. that will fly 80 mi. to the gallon of gasoline, at a speed of 70 mi./hr. across country.

This type of machine should eventually cost only about £1,000—it can land and take off in any small piece of ground.

Trials held last October were most successful, and one or two of the competitors reached altitudes exceeding 13,000 ft. with engines of only 5 or 6 hp.

We believe that it will not only make aviation popular among young men, by means of either privately owned machines or by the establishment of light-airplane clubs, but also it will be a cheap and useful means of training military pilots in the first stages of flying.

Accidents with these little machines do little or no serious damage either to themselves or to the pilots, owing to their extreme lightness, and in the event of engine failure, they can be made to go on gliding through the air for a considerable time before coming to earth.

British Airship Plans

As regards dirigible airships you are well ahead of us at present, but we are no longer standing still. We purpose linking the Dominions together as closely as the British Isles

(c) Keystone View Co

Capt C M G Christie, British air attache in Washington, bidding farewell to the Duke of Sutherland when the latter sailed for home on the S.S. Aquitania

have already been linked to the Continent, starting with an airship line between England and India. A commercial company, subsidized by the government, to a limited extent, with an initial amount payable at the commencement of operations, will help to work this great scheme which although approved by the British Cabinet, has still to get the sanction of parliament. The Company will have to erect mooring masts at fixed points on the way to the East, the first will be placed in Egypt. The flight to India must be completed in five days, and the dirigible must carry a weight equal to 100 passengers on that journey before the Company can receive their second subsidy. After that, six airships, each of which will be of five million cubic feet, will be built, and the journey to Australia should be made in ten days instead of six weeks as by the present sea voyage, that is to say, in one quarter of the time.

This enterprise, if successful, will be of great value in the British Empire, not only on account of the quick transit of passengers but by the speeding up of the mail service to the East.

The airships will be so constructed that they will have all the comforts of an ocean liner for their passengers. It will take 18 months to build the first of these monsters. Their success is, of course, problematical, but we believe their possible future value to the Empire makes it well worth while to try them, despite disasters that must occur from time to time in all great advances in human progress. We all deeply deplore the recent accident to the French airship Dixmude, involving as it did the loss of so many gallant French airmen, but one must remember that this dirigible was of light military construction, built some years ago, and not comparable in measures of strength and safety to those designed for modern passenger-carrying airlines.

Canada Ahead of U. S.

In the essentials for civil aviation development I think that Canada is also a little ahead of you, in that her government in conjunction with our own by becoming a member of the International Convention of Air Navigation, has agreed to certain rules within her own boundaries and has passed laws controlling the issue of pilots' licenses and certificates of airworthiness for passenger-carrying aircraft, thus insuring the safety of the public and generally regulating activities on a proper transportation basis.

No doubt the United States for similar good reasons will soon establish some such rules, even if she should not become a member of the International Convention. This also will reduce the present high cost of insurance, for pilots and machines, and make aerial relationships with other countries easier. If, as I believe will one day be the case, aviation is to become generally popular and people are to fly from place to place as readily as they now take the train or car, no precaution to make flying safe for the public should be omitted. In Europe we believe that civil aviation can do much to bind countries together in a spirit of good feeling and mutual friendship, owing to the absence of boundaries and frontiers in the air.

It seems to me that through encouraging air traffic between the United States and the Dominion of Canada the British Empire will be brought into more and more intimate contact with your great country. I welcome this particularly as my personal associations with our wonderful Northern Dominion are very close and extend westward from my ranch in Alberta to British Columbia. Indeed, I take a pride in calling myself "half a Canadian," and I hope that you, my invisible Canadian friends who happen to be listening in, will accept this as an expression of sincerity. The gallantry and skill of Canadian pilots of the Royal Air Force in the late war will never be forgotten, as also the superb fighting qualities of the Canadian armies. It is pleasing to note the steady progress of aviation in Canada; the aerial forest patrols whereby large sums of money have been saved, the recent remarkable achievements in surveying the great Northern areas by photography from airplanes would seem to prove that in this branch Canada leads the world.

The British Air Force is organized as a separate service on an equal and friendly partner with our army and navy. You may recently have read of our decision to enlarge it by 52 new squadrons. This expansion is in no way connected with the construction programs of other countries. As far as we are concerned there can be no talk of any race in air armaments, we merely feel we must possess an Air Force commensurate with the size and importance of the Empire. In our protective mandates Mesopotamia and Palestine our Air Force is in command and polices the country much more economically than would be possible with the employment of ground troops.

Aviation is no menace—rather a modern method of facilitating more intimate communication between nations. I feel that we must develop it as a means of progress and enlightenment rather than as an employment of destruction, and toward this end I am confident that our two great English-speaking nations will always cooperate. Let us work together in harmony and friendship for the cause of world peace and good will among nations.

Chicago's Need of an Airport

Chicago's urgent need of a properly equipped airport was made apparent at the recent aerial carnival held by the Army Air Service in behalf of the Army Relief Society at Ashburn Field.

Countless automobiles, says Air Service News Letter, moving at a snail's pace failed to find parking space on the broad acres surrounding the field. Because of poor drainage. No heavy rain had fallen between Oct. 17 and Nov. 11, and yet the landing field and the encircling prairie was soft in mud. Wise motorists would not risk the fields, where there was room, but stayed in the road, impeding traffic further. The unwise did park in the fields with the tragic results that many fine limousines were hurried knee-deep in mire. As night fell, crews of men were scattered hither and yon tugging away, trying to drag them out. Many were left for wrecking crews to handle. Thus thousands who could not navigate the main narrow road leading to the field, did not see the demonstration, did not contribute to the relief fund, and were forced to go home disappointed.

Throughout the meet a baby tractor was in constant service hauling ships from the mud in the field. A Martin Bomber could hardly pull itself off the wet ground. The Barling Bomber, warned at Chanute Field by radio, did not attempt a landing, but contented the assemblage with circling the field twice, then speeding off to the dry turf of Maywood.

All of those interested in aviation (both military and civilian) should bend every effort to the end of getting Chicago a good field—or fields—worthy of the city and its importance in future air developments. The Air Service Officers' Association has launched a determined campaign for a field, and the effort promises to bear fruit. It is a worthy cause and deserves everybody's strong support.

AIRPORTS AND AIRWAYS

Cigar Company Operating Planes

Another example of the growing utilization of the airplane for advertising purposes is furnished by the Manchester Cigar Co. of York, Pa., which is the owner of two machines. The advertising stunt in this case is for the pilot to explode a smoke bomb to attract attention and then drop circulars.

In this work for the cigar company pilot Karl S. Ort, formerly an Air Service lieutenant, has flown 22,000 mi. over twenty-two states in 400 hr. flying time, during a period of nine months. Pilot Ort, who returned to his home at York for Christmas, resumed the cigar company's advertising campaign in the South the first of the new year.

At Richmond, Va., Ort was the first person taken into custody charged with violation of the local air traffic laws. He was arrested on a warrant charging him with disorderly conduct in connection with the explosion of "bombs" and the distribution of literature in midair. The noise of the explosion of the "bombs" it was claimed, frightened a horse and caused it to run away. Ort's arrest was ordered by the chief of police. The members of the force wondered how their chief expected them to arrest a man in midair, but this was not necessary. Lieutenant Ort was found by an officer in a restaurant late in the afternoon after most people had forgotten about the disturbance.

"What do you want me for, speeding or not having my lights on?" he asked the policeman.

"Neither," said the officer, "you failed to hold out your hand while passing Ninth and Broad streets a while ago."

There was a brief suspense and the aviator was informed that a warrant had been sworn out against him and that he was really under arrest. In police court he was fined $2 on the disorderly conduct charge. The fine was paid cheerfully, as the publicity was worth many times that sum in advertising.

As a result of the York aviator's aerial stunts, the authorities of Macon, Ga., according to telegraphic reports, will undertake to control the air over that city. An ordinance was passed by the city council giving the police powers of the air to the inspector of license and tax. However, the new air "cop" was not provided with an airplane, which will be needed to keep the traffic clear in the clouds, so the speeding through the zone will likely continue until such action is taken. The alderman who introduced the ordinance gave as his reason for introducing such a measure the danger of aviators flying low over the city for the purpose of distributing publicity literature.

Rodgers Field, Pittsburgh, Pa.

After three years of endeavor the plan for a municipal aviation field at Pittsburgh, Pa. is nearing fulfillment. The county commissioners have formally approved the city's project to acquire a 43-acre tract near Aspinwall, so that after a few legal requirements are complied with, Pittsburgh will possess one of the finest flying fields in the country. It will bear the name of Rodgers Field, fittingly commemorating the late Calbraith Perry Rodgers, the first person to fly across the continent in an airplane. It was not a continuous flight, of course, but it recorded a pioneer achievement of great value, stimulating the later ambitious efforts to fly from the Atlantic to the Pacific in a single day that have been crowned with success. That was in 1911 and Rodger's airplane has long been on exhibition in Carnegie Museum.

The Aero Club of Pittsburgh has adopted the following resolution regarding the naming of the field:

Whereas: Aviation publications of national circulation are reminding those responsible for establishing flying fields that certain famous pioneers of the art of flying should be remembered in the naming of new fields, and

Whereas: This reminder includes, among others, the name of a Pittsburgher, Calbraith Perry Rodgers, who was the first man to fly from the Atlantic to the Pacific Oceans across the United States and whose plane has been given a permanent resting place in the Carnegie Museum of this City, and

Whereas: Calbraith Perry Rodgers had, before his accidental death in 1911, contributed greatly to the practical element of the science of that other Pittsburgher Dr. Langley of the Allegheny Observatory, and had established records which, as standards of achievement, remained unbroken for many years after his passing; therefore, be it hereby

RESOLVED: That the new Municipal Landing Field for the City of Pittsburgh and Allegheny County should be named "Rodgers Field," and further

THAT a copy of this resolution be addressed to the Honorable Mayor of the City of Pittsburgh, and to the Commissioners of Allegheny County, and to the members of the City Council, and to the office of the Chief of Air Service, U. S. Army, and to the public press.

Needless to say, AVIATION particularly rejoices in this merited tribute to Calbraith P. Rodgers, one of the great American airmen whom we mentioned in an editorial published in our Sept. 24, 1923, issue as deserving lasting recognition.

Underwriters' Aviation Record

In the annual report of the Underwriters' Laboratories of Chicago the activities of its aviation department are reviewed as follows:—

"During 1923, the second year of this Department, we find little or no increase in the volume of business other than to note that the class of work has increased in quality. That is, the operators of aircraft seem to be of better business standing and actually accomplish some definite results in aerial transportation.

"During the year Maj. R. W. Schroeder, who handles the affairs of this Department, has been very active in assisting the Gases and Oils Department with their investigations and tests of domestic oil burning devices. This materially cuts down the overhead of the Aviation Department.

"The results of the work of this department during the two years of its existence may be summarized as follows:

Aircraft for private use entered in Underwriters' Laboratories' Aircraft Register	10
Aircraft for commercial use entered in Underwriters' Laboratories' Aircraft Register	25
Airworthiness Certificates issued	10
Certificates issued to registered pilots	39

"Thirty-two resident aviation engineers located in the principal aviation centers of the United States have been appointed as representatives of this Department to render service."

Contract for Night Flights

The Aero-Lite Advertising Co. of Indianapolis, Ind., recently landed a big advertising contract for night flights, using electric signs built in the lower wings of "Jennies." Harry M. Storms, formerly a comercial pilot of Kokomo, Ind., is one of the fliers for the Indianapolis firm, and in his first flights over Kokomo the flashing signs attracted a lot of attention.

New British Round the World Flight

Squadron Leader A. S. C. Maclaren, of the British Royal Air Force, will attempt next spring to fly around the world in a Vickers Viking amphibian flying boat equipped with a 450 hp. Napier Lion engine. He will be accompanied by Flying Officer W. N. Plenderleith and Engineer Sergeant Andrews. The British air ministry is backing this expedition.

Baltimore News

By W. D. Tyden

The 29th Division Air Service of the Maryland National Guard has folded its wings for the winter and has commenced its schedule of armory training, meeting every Friday night at its armory. A class for officers under instruction of Capt. Chas. T. Phillips, Air Officer of the Third Corps Area, and in addition Instructor of the Air Service, M N G., is now in full swing. The course covers the regular curriculum given at the Air Service Tactical School at Langley Field, insofar as observation aviation is concerned. The course is interspersed with lectures by instructors from other branches of the service, whereby a fuller knowledge of cooperation with other arms is obtained. Capt. Edwin H. Johnson has given two lectures on administration. Capt. Rhodes Arnold will give a course in pistol marksmanship, including indoor instruction and outdoor firing. This series will supplement the course given last winter and spring. The Air Unit has its own range at Logan Field.

Courses for enlisted personnel include one in rigging, in which a regular stripped JN is used, the students going through all the operations of rigging. This class is instructed by Lieut. Roht. J. Stewart, Engineering Officer of the Air Unit. The engines course is handled by Master Sergeant Chas. H. Craig, in charge of the permanent detail at Logan Field. It includes all the operation necessary to service the 150 H.S. engine which is used for instruction purposes. Other classes include the Photo, under Sergeant Stevens of the Photo Section; Radio, under Lieut. W. O. Snyder; and gunnery under Master Sergt. Roy Cotter of the permanent detail. Scheduled flying will commence April 1, while voluntary flying is being done all winter.

The Flying Club has completed a five year lease for Logan Field, which goes into effect July 1, 1924. Plans are being prepared for two new steel hangars and the entire field layout is being altered. It is hoped that the hangars can be erected this winter. Both the city and State share in the rental of the field, giving further evidence of harmony in our flying circles.

The American Aircraft, Inc., which has its plant at Logan Field, recently took over a batch of Bellanca two-seaters, built by the Maryland Pressed Steel Co., a subsidiary of the Poole Engineering and Machine Co. There is a great demand for these planes, some being bought by enlisted men of the Air Unit who have learned to fly.

The Skysayne Corporation, doing night and day aerial advertising, is getting its equipment ready for flying when milder weather comes. This company has three Canucks specially arranged for aerial advertising.

St. Louis News

By Manuel Haha

The winter months have set in, and St. Louis flying is mostly confined to indoor flying. However, the ships belonging to the 110th squadron and the Flying Club have been in the air on every opportunity.

The Flying Club of St. Louis, under their new president, Charles S. Powell (whose name was erroneously given as John Powell in a preceding issue) has carried on, particularly they have celebrated a program, sketched in the last days of the preceding administration, and are now about to begin the building of a new Club House at the St. Louis Flying Field. This will not be an ambitious affair, but will have one great room for spreads and the like, and smaller locker rooms and kitchen.

The club is also negotiating with certain hotels and restaurants to give holders of guest cards a preferential price. This will probably take the form of a discount. In addition, one of the largest clubs in St. Louis is being approached to give the privileges of its guest cards to holders of the Flying Club's guest cards.

George S. Johns, who carried the message of the National Aeronautic Association to the countries of Europe, was tendered a dinner by his friends upon his recent return. In part he said:

"I found England anxious, unofficially, to take part in the next International Air Races. But officially they are slower. The unofficial enthusiasts say, 'It is right we should compete, but without government aid we cannot.'

"In France they will, I fell sure, compete. But there they are spending more money.

"Belgium cannot be interested. But I think we shall see Italy in the next races."

A New Federal Air Bill

The Department of Commerce, the Inter State Commerce Committees of the House and Senate are working out the details of a bill for the regulation of interstate flying and aircraft, Secretary Hoover announces. As models of the new legislation, he explained, the Winslow and Wadsworth Bills are being used, but it is planned to modify and shorten these bills which failed to pass both houses last session.

The result of a suitable bill for the regulation of air navigation would tend to popularize this means of transportation in this country, he believes, as well as to stabilize the industry, which has little business except through manufacturing military and naval planes. Adequate inspection of aircraft and the knowledge that pilots were well-trained and experienced would aid the development of aerial transportation. These features will be incorporated in the proposed bill to establish a Bureau of Civil Aeronautics in the Department of Commerce, the Secretary said. Congressman Winslow has requested the aid of the Department in working out the details of the bill, while Senator Wadsworth is also interested on the Senate side, it is understood.

During the past year, Secretary Hoover believes, accidents to aircraft were due in a large part to the faulty craft and inadequately trained pilots. The public, he inferred, would be much more interested if the flight of aircraft were controlled with the same precautions as are applied to the operation of ships and railway trains. There will be more public confidence in air travel when more safety is assured, through proper inspection of craft and testing of pilots, he declared. In Europe, he pointed out, inspection is particularly vigorous. The cooperation of the whole aeronautical industry is offered to the framers of the United States bill, it is understood.

Other problems demand research, he stated, explaining that he referred to air routes, landing fields, etc., in which municipalities and perhaps states would aid. Legal questions got involved in the 1923 air bills, the Secretary explained, and for this reason, he believes they failed of passage. Under the proposed bill, inspection of civil planes and airships, and the examining and licensing of pilots would be handled by the new Bureau of Civil Aeronautics, separately and distinctly from the military and naval planes and pilots, just as is done today with commercial ships and their navigators and skippers by the Bureau of Navigation.

British Imperial Air Transport Co.

Some additional information is on hand regarding the Imperial Air Transport Co. which was recently formed with a capital of £1,000,000 for amalgamating the existing four British air lines, namely, Daimler Airway, Handley Page Transport, Instone Air Line and the British Marine Air Navigation Co.

The agreement between the British government and the British, Foreign and Colonial Corp., Ltd., which will finance the new air combine, provides for the appointment by the government of two directors on the board of the projected company. The appointees are Sir Herbert Hambling, chairman of the Civil Air Transport Subsidies Committee—which recommended the establishment of a single national air line—and Maj. J. W. Hills, who was financial secretary to the Treasury in Mr. Bonar Law's government.

It is further stated that Sir Eric Geddes is slated to be chairman of the new concern, and that among the directors will be Lord Invernam—better known as Sir William Beardmore, head of one of the great British shipping and aircraft concerns—Sir George Beharrel, a railroad man who performed conspicuous service during the 1914-18 war, and representatives of the existing British air lines.

An important stipulation in the agreement is that all air line pilots and 75 per cent of the ground personnel, whether administrative staff or mechanics, shall be members of the Royal Air Force Reserve.

Courtesy, N. Y. Herald

J. R. Cautley with Perrot Brake

John R. Cautley, formerly of the Wright Aeronautical Corp. of Patterson, N. J., has become associated with Vincent Bendix in the Perrot Brake Corp., South Bend, Ind., manufacturers of four wheel braking systems. Mr. Cautley will take charge of operations as vice president and general manager.

New Italian Air Force Commander

Col. Pier Ruggero Piccio, Italian air attaché in Paris, has been appointed commandant general of the Italian air force in lieu of Col. Ricardo Mozo, who is temporarily incapacitated as the result of a flying accident. Colonel Piccio commanded the Italian pursuit aviation during the war.

U. S. ARMY AND NAVY AIR FORCES

Hawaiian Air Service in Simulated Warfare

Air Service troops stationed at Luke Field and Wheeler Field, Hawaii, recently participated in the annual simulated warfare program which was carried out by the entire Hawaiian Department on the Island of Oahu. According to primary orders received by the different branches of the service, enemy troops have succeeded in subduing our Navy and have conveyed transports off the coast of Oahu, writes Lieut. J. M. McCulloch, A.S., in Air Service News Letter.

The maneuvers of the Air Service were extremely interesting in that practically all missions assigned to that branch entailed night flying, bringing out many instructive points in the flying of night formations and dropping messages which have been practiced here during the past year.

Three Martin Bombers from Luke Field, simulating enemy planes, were to bomb the naval base at Pearl Harbor. Anti-aircraft regiments were defending this point with their searchlights and anti-aircraft guns, but were unable to spot the ships which were flying at an altitude of 7,000 ft.

The same morning, another flight of three DeHavilands left Luke Field headed for the eastern coast of Oahu, and upon reaching Kaena Point, turned on their wing lights and became enemy planes, using as their objective the naval base at Pearl Harbor also.

One hour later, two flights, one consisting of three Martins, and the other three DH4B's, took off, both simulating hostile ships. The Bomber flight headed for Kaena Point, northwest of the airdrome, while the DH flight turned toward Makapua Point, east of the starting point. The return of these two flights was synchronized so as to reach their objective (naval base at Pearl Harbor) simultaneously.

Pursuit ships were brought into the affray when a message, received by the Commanding Officer of the 6th Pursuit Squadron, Luke Field, ordered an attack on the enemy landing at Waimanolo Military Reservation. The message was received at Luke Field at 5:30 a. m., 37 min. after its issuence, and 5 min. later all ships were in the air. The mission was fully carried out in 24 min., making a total of 61 min. from the time the message was ordered until it was completed.

Flying Off the Map

Flying completely off the map was the experience of a group of airmen from McCook Field, who took off in a 35,000 cu. ft. balloon on Dec. 12 at 9:15 a. m. for a free balloon flight. The passengers were Capt. Wm. B. Mayer, pilot, Maj. H. A. Strauss, Lieut. Robert E. Robillard, and Lieut. Ira R. Koenig.

Weather conditions were steady with S. by S.W. ground winds of a speed of 11 mi./hr. Because of this low velocity, only a map of southern Ohio was taken. The balloon had started off in a southerly direction, but upon rising to 3,000 ft. struck a cross current wind with a velocity of 45 mi./hr. In three hours southern Ohio was left behind and the map discarded. Judging that they were headed in the general direction of Cleveland, they decided to come down after a time to try to obtain more specific information. Flying low they shouted their questions at some upturned faces they passed above in the fields. The questions were heard without difficulty, but by that time the ground wind had increased to 35 mi./hr. and travel was so fast that they could not catch the answers. However, emphatic gestures aided, and rising again they saw the outskirts of Cleveland in the distance.

On landing the gas did not leave the balloon immediately upon pulling the rip panel, and for a moment it seemed as if the balloon might be carried into dangerously wooded territory, but suddenly the balloon collapsed and a safe landing was effected in a 35 mi./hr. wind, five miles from the little town of Macedonia.

The trip was made for the purpose of testing out the rate-of-climb indicator. A recording barograph, an altimeter, and a statoscope were also carried. In conformance with the new regulations, all passengers were equipped with parachutes. The balloon type, attached to the rigging of the balloon, was used. The flight lasted 4 hr., and a distance of 176 mi. was traveled.

Plans for World Flight

Detailed plans for the world flight of the Army Air Service are being worked out by a Committee working under the direction of the Chief of the Training and War Plans Division, Office of the Chief of Air Service. This committee will continue to function as long as needed and will make all its information and plans available to the flight personnel, including the advance officers. The committee consists of the following officers, who are responsible for the duties listed after their names: Capt. Wm. F. Volandt, transportation and finance; 1st Lieut. St. Clair Streett, route, maps, general organization and information; 1st Lieut. Robert J. Brown, Jr., chairman, organization and co-ordination; 1st Lieut. Erik H. Nelson, equipment and engineering; 1st Lieut. Clarence E. Crumrine, equipment, engineering and route, advance officer; 1st Lieut. Elmer E. Adler, supply.

The purposes of the proposed flight are to gain for the Air Service added experience in long distance flying and particularly in the supply problems connected therewith, to complete an airplane flight around the world in the shortest practicable time, to demonstrate the feasibility of establishing an airway around the world, and incidentally to secure for the United States, the birthplace of aeronautics, the honor of being the first country to encircle the world entirely by air. Much valuable information on the difficulties of operating aircraft in various climates will also be obtained.

Army Orders

Maj. Harrison H. C. Richards, A.S., appointed acting quartermaster, issuing bills of lading and transportation requests, Office, C.A.S., vice First Lieut. Earle G. Harper, A.S.

Leave Sec. Lieut. Joseph A. Physioc, Jr., A.S., extended three months.

First Lieut. Dudley E. Rowland, A.S., Mitchel Field, detailed as instructor Connecticut National Guard, Hartford, on expiration of leave.

Capt. Carl W. Connell, A.S., from Aeromarine plant, Keyport, to Boeing Airplane Corp., Seattle, as Govt. representative.

Sec. Lieut. Don W. Maybue, 76th F.A., Fort D. A. Russell, detailed to A.S., Primary Flying School, Brooks Field for instruction.

Ten days' leave to First Lieut. Reuben C. Moffat, A.S., from Dec. 22.

Leave First Lieut. Aubrey I. Eagle, A.S., extended 15 days.

Fast Antelopes

Relating various incidents in the 8000 mi. flight from Langley Field to the Pacific Coast and back, made in a Martin Bomber, Lieuts. J. F. Whiteley and H. D. Smith, A.S., Air Service News Letter tells of the following remarkable experience —

"They had the unusual experience of chasing a herd of antelope over the plains of Nevada. The airplane was only about 200 ft. above ground, and the aviators were not making very much progress because a high wind was blowing directly against them. The antelope must have thought that a destroying monster was pursuing them, and they ran as if the very devil was after them. Lieutenant Smith says that the antelope made better time than the airplane and ran away from it, as the speed of the plane was retarded by the wind."

Kelly Field Air Carnival

The Air Service activities centered around San Antonio, Tex.—the Primary Flying School at Brooks Field, the Advanced Flying School at Kelly Field and the San Antonio Air Intermediate Depot—combined forces and staged an air tournament at Kelly Field on Nov. 16 for the benefit of the Army Relief Society.

Throughout the program mist and, in some instances, light rains prevailed, so at four o'clock the program was terminated and visitors issued rain checks good for the next Sunday. The show, although not embracing all of the exhibitions planned, was a huge success from the spectators' standpoint. The day, however, was marred by the crash of Lieut. Paul T. Wagner and his death which followed.

The San Antonio Air Intermediate Depot furnished eighteen types of airplanes and their accessories for the ground exhibit, which was arranged to show all stages in the process of assembling and rigging airplanes, wing and propeller construction, application of dope and varnish, and motor overhaul and installation.

A feature of the Carnival was the arrival from Scott Field, Ill., of the Army Airship TC3, manned by a crew consisting of Capt. L. T. Miller, 1st Lieuts. Arthur Thomas and R. S. Heald, pilots; 1st Lieut. Alfred I. Purvear, student pilot; Master Sergeant Gamble, coxswain, and Sergeant Neff, engineer. Due to the bad weather on the day of the exhibition, the ship remained in San Antonio until the following week in order to take part in the exhibition given on Sunday, Nov. 25. During the interim the airship made a flight to Fort Worth, Tex., where it received an enthusiastic reception by the people of the city.

Authority being requested and received from the Office of the Chief of Air Service to hold another Carnival on the following Sunday, an advertising campaign was conducted, not only through the newspapers but also by planes with advertising painted on the lower wings. The newspapers gave the affair their whole-hearted support.

Although "Old Sol" disappointed everybody and raised particular havoc on the 18th, he relented at about 10:00 a. m. on the 25th, and promised perfect weather. By 12 o'clock some odd thousand visitors had arrived, and by 2:00 p. m. it was estimated that between 18,000 and 20,000 people were ready for the show.

The first thing on the program was the landing of the TC3. This ship caused a great amount of comment among the spectators, who marveled at the maneuverability and ease at which the ship operated. A free balloon flight by Major Westover and Lieutenant Burt followed the ascension of the TC3. At 2:00 p. m. the clearance flag was given, and the first heavier-than-air events started. This consisted of SE's, VE9's, DH4B's, Sperry Messengers, NBS1's, JN6H's, GAI's and XB1A's. Following in the order named were aerobatics, apron-string formation, balloon-breaking, parachute jumping, sky writing, bombing, etc. The apron-string formation by Sergeants Newcomb, Mitchell and Kelly from Brooks Field, who flew three Voughts tied together with 40 ft. strings, was a sensation, not only to the spectators but to other pilots as well. The formation passed the reviewing stand several times, the strings in all cases overlapping or dragging at least ten feet.

The parachute jumps were a huge success and furnished plenty of thrills. Two simultaneous jumps from two DH's were as pretty a sight as one could hope to witness. Sergeant Bottrell, a veteran parachute jumper, shipped his parachute vertically for several thousand feet, at about 500 ft., however, he released the cords and made a perfect landing.

The sky-writing by Lieutenant Brookley caused gasps of amazement from all who witnessed his work. After completing his writing he gave an exhibition of stunts which alone were worth the price of admission.

The ground attack and demonstration of maneuverability by the Attack Group of Kelly Field was particularly interesting to all who witnessed it. Cross-over turns, line formations, V and column formations were demonstrated before the crowd. At the close of this event an attack was made with terra cotta bombs and machine guns on a simulated enemy position, located approximately in the center of the field. The event was spectacular as well as interesting and seemed to please the crowd very much. Formation stunting followed. A tug-of-war between a Martin Bomber and a Liberty truck was the next thing on the program, and furnished considerable amusement for everyone. It was nip and tuck for several minutes, but the Liberty truck finally dug in and all the king's horses and all the king's men plus one NBS1 failed to move it.

Altitude stunting and a combat between Lieutenant Schneider in a Sperry Messenger and Lieutenant Canfield in a Martin Bomber followed. This, from a flier's point of view, was probably the most amusing event of the day. The altitude had been limited to 500 ft., and this engagement was without doubt one of the most comic of all on the program. The Sperry Messenger, which was caught in the propeller blast of the Martin, seemed to go through all the gymnastics possible. A draw was finally declared.

The smoke-screen ship, piloted by Captain Duncan, made a great hit with the crowd. He laid a perfect smoke screen the length of Kelly Field, and this was one of the most gorgeous sights one could hope to witness. The TC3 then landed for a final inspection by the spectators and the show concluded.

From 12:15 until dark three Martin Bombers, eight DH4B's and five JN6H's were kept busy ferrying passengers. The Carnival was a huge success, not only from a spectator's standpoint but from a financial standpoint as well. The amount realized from the Show is believed to approximate $7,500, including concessions, general admissions, programs, etc. Although not mentioned before, Mr. Ruggles, inventor of the Ruggles Orientator, who is now at Brooks Field, brought two of his ground planes over and demonstrated with visitors as pilots the various stunts that could be performed in these machines.

Reserve Officers Graduate at McCook Field

A class of six Air Service Reserve officers just completed the annual three-months' course given at the Air Service Engineering School, McCook Field. These officers were called to active duty on Sept. 1 and ordered to Dayton for instruction in Maintennnce and Aircraft Engines.

During the course two Wright Hispano 180 hp. engines were completely inspected, overhauled and tested by the officers. One of the engines has given a satisfactory performance in the air for many hours and the other will be flown shortly. In addition, various types of airplanes were completely inspected, rigged and conditioned for flight and flown by members of the class. Each officer was placed on flying status and permitted to fly several types of airplanes, although the course was not one specializing on flying. The opportunity to attend the Pulitzer Races at St. Louis, making the trip by air, was greatly appreciated and certainly proved to be one of the most instructive parts of the course.

The officers, whose names follow, left for their respective homes and former lines of business: Capt. D. M. Speer, Chicago, Ill.; Lieut. H. J. Brady, New York City; Lieut. F. H. Clewers, Tippecanoe City, Ohio; Lieut. O. B. Crawford, San Fernando, Calif.; Lieut. E. G. Knapp, Fenton, Mich.; Lieut. H. I. Sands, Fargo, N. D.

New Army Transport Plane Ready

The first of the Army transport planes, an order for ten of which was given to the L.W.F. Co. over a year ago, has been completed and flown to McCook Field, Dayton, Ohio, for official tests. This machine, it will be remembered, is the result of competitive designs and bids for 10 transport planes. The L.W.F. Co. by submitting a design based on Douglas torpedo plane wings and landing gear, the jigs and patterns for which were available in that plant, were able to underbid other manufacturers and secured the order.

DH's Sold to Mexico

The American government has sold to the Mexican government five thousand Enfield rifles, Model of 1917, five million rounds caliber thirty ammunition and eight DH4 airplanes, the terms of the sale being one-half cash and one-half within thirty days. These articles do not cover the entire list requested originally, but the Mexican government finds they will answer its present requirements.

Reserve Officers Assigned to Regular Army

To insure the ready and effective operation of the National Defense Act in time of emergency, Reserve Officers of the Territorial Assignment Group are to be assigned to active units and organizations of the Regular Army in sufficient number to bring those units to the authorized war strength Authority for this assignment is given in a letter from The Adjutant General of the Army to all Corps Area Commanders and Chiefs of Branches. This assignment does not call for active duty unless ordered thereto

The vacancies in the Air Service units of the Regular Army to which Reserve Officers may be assigned are as follows:—

First Corps Area (Me., N. H., Vt., Mass., Conn., R. I.)—None

Second Corps Area (N. Y., N. J., Del.)—Five captains, 8 first lieutenants, 3 second lieutenants. Total 16

Third Corps Area (Pa., Md., Va., D. C.)—Four captains, 46 first lieutenants, 30 second lieutenants. Total. 80

Fourth Corps Area (N. C., S. C., Ga., Fla., Ala., Tenn., Miss., La.)—Two captains, 2 first lieutenants. Total 4

Fifth Corps Area (Ohio, W. Va., Ind., Ky.)—Two captains, 2 first lieutenants. Total 4

Sixth Corps Area (Ill., Mich., Wis.)—Three captains, 20 first lieutenants, 28 second lieutenants. Total 51

Seventh Corps Area (Mo., Kan., Ark., Iowa, Neb., Minn., N. D., S. D.)—Two captains, 2 first lieutenants. Total 4

Eighth Corps Area (Tex., Okla., Colo., N. M., Ariz.)—Six captains, 48 first lieutenants, 33 second lieutenants. Total 87

Ninth Corps Area (Wash., Ore., Idaho, Mont., Wyo., Utah, Nev., Calif.)—Two captains, 2 first lieutenants. Total 4

Altitude Flight in a DH Airplane

For the purpose of testing a new side-type supercharger, Lieut. Harold R. Harris, pilot, and Mr. Morse, observer, made a flight on Dec. 13 from McCook Field in a standard DH airplane, which had been fitted for this trial with a special steel engine mount and an underslung radiator. The side-type supercharger, with which the DH was equipped, is the first of its type developed for use with the Liberty engine. Its weight is 125 lb. and it has a rated altitude of 20,000 ft., but by overspeeding can be made to work up to 30,000 ft. Standard gaseous oxygen tanks were carried.

During the climb readings of engine, airplane and supercharger conditions were taken every 2,000 ft. The oil pressure went down to a low figure with increased altitude, and so much water was lost due to improper settings of the radiator relief valve that the motor lost considerable power. However, an indicated altitude of 20,400 ft. (afterward corrected to 27,000 ft.) was made which, beyond doubt, was an event in the life of a standard DH, and no mean success for the supercharger. The duration of the flight was 43 3 min. Lieutenant Harris made the descent in 14 9 min., or at the rate of 17½ mi./hr. The lowest temperature encountered was 29 deg. below zero.

Small Angular Oscillations in Steady Flight

N.A.C.A. Report No. 174

This investigation, by F. H. Norton, was carried out by the National Advisory Committee for Aeronautics at the request of the Army Air Service to provide data concerning the small angular oscillations of several types of airplanes in steady flight under various atmospheric conditions. The data are of use in the design of bomb sights and other aircraft instruments.

The method used consisted in flying the airplane steadily in one direction for at least one minute, while recording the angle of the airplane with the sun by means of a kymograph.

The results show that the oscillations differ but little for airplanes of various types, but that the condition of the atmosphere is an important factor. The average angular excursion from the mean in smooth air is 0.8 deg. in pitch, 1.4 deg. in roll, and 0.9 deg. in yaw, without special instruments to aid the pilot in holding steady conditions. In bumpy air the values given above are increased about 50 per cent.

PUBLISHER'S NEWS LETTER

We are glad to receive the following definite statement from the Chief of the Air Service concerning *Slipstream*, the self-styled "publicity agent" of McCook Field:

"The January number of *Slipstream* will be the last issue of that magazine to be published by anyone having any connection whatsoever with the Engineering Division. If the magazine is continued after that time, it will be operated entirely as a private enterprise by individuals with no connection with the Air Service and any information therein will be such as is available to any other magazine that desires to obtain it."

It is apparent from the above decision that any overstepping of the bounds of propriety on the part of the inexperienced promoters of *Slipstream* was in spite of official supervision rather than with its sanction.

* * * *

Only by cooperation of all interested in the advancement of our air progress can we realize our ambition to make the United States "first in the air." The Aeronautical Chamber of Commerce, The National Aeronautic Association, The Society of Automotive Engineers, and the local aero organizations should by their common interest reach an understanding as to the essential requirements at this time. The Chamber of Commerce should not speak for the industry alone, nor the N.A.A. solely for the public interest, nor the S.A.E. exclusively for the technical side. They all should use their great influence to advance in common certain basic purposes. As three instances, there might be cited the passage of the Civil Aeronautics Bill, the development of a sound aircraft industry, and the promotion of air routes and airdromes.

* * * *

The visits to this country of several prominent representatives of British aviation has given American constructors an interesting insight into the methods by which the British government keeps an aeronautical industry in existence. Everyone, including our Air Service officers, agrees that the fundamental necessity of our national air defense is a sound and progressive industry for the production of aircraft. Our industry has shriveled to a point where the most optimistic constructor is discouraged. As we have stated many times, the disappearance of such companies as the Dayton-Wright division of the General Motors Corporation is only to be expected under the methods obtaining here. The British and French encourage their industry to maintain engineering staffs and production organizations which contribute to the advancement of their aviation. Here, those organizations that have attempted to continue experimental and engineering departments, with one or two exceptions, have found their efforts in this direction involving such a heavy loss that the tendency has been to curtail developments of new types to a minimum or to the most pressing requirements of the moment.

* * * *

From the advertisements in English and French aviation magazines, which are true indexes of the state of the industry in those countries, it will be seen that practically all airplanes, motors and accessory manufacturers have something to sell and advertise. The real reason is that the foreign manufacturers are allowed to keep a proprietary interest in their development work and are given orders for their own aircraft to the extent of their facilities. While the government ownership of reproducing rights may have the merit of securing a low price in production orders, it is the most expensive in the long run, for it throws back on the government the expense of practically all experimental design. If private initiative were to be allowed an opportunity to bear this burden with a prospect of adequate rewards in the form of production orders, the competition would attract engineering talent which is now at work in other fields.

* * * *

Another effort that might be productive of good results would be in the direction of greater solidarity among our aircraft constructors. Scattered as they are from coast to coast, and all trying to keep their factories going by securing orders through every known art of selling, they do not have that personal contact with one another that brings unity of purpose. Some constructors favor one government practice that fits their purpose at the time, while others are opposing the same procedure. It is essential at this time that they all agree to certain basic points of procedure so that all will know where they stand with respect to government orders. No more friendly suggestion can be thought of at this time than the urging of cooperative action on the part of the constructors that compose our aircraft industry.

AERONAUTICAL CHAMBER OF COMMERCE DIRECTORY OF ACCESSORY, PARTS AND MATERIAL MANUFACTURERS

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AIRCRAFT DEVELOPMENT CORP., General Motors Bldg., Detroit, Mich. **Lighter-than-air equipment, airship engineering and design.**

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AMERICAN BRONZE CORPORATION, Berwyn, Pa. **Bronze for plain bearings; Bushings.**

AMERICAN GAS ACCUMULATOR CO., Elizabeth, N. J. **Aerial Lighthouses, Rotating Beacons; Field Limitation Lights; Ground Wind Indicators.**

AMERICAN HAMMERED PISTON RING CO., Baltimore, Md. **Piston Rings.**

H. BARBER, Aviation Dept., Hartford Fire Insurance Co. and Hartford Accident and Indemnity Co., 30 E. 42nd St., New York City. **All classes of Insurance.**

B. G. CORPORATION, 136 W. 52nd St., New York City. **B. G. Spark Plugs.**

BIJUR MOTOR APPLIANCES CO., 243 Central Ave., Hoboken, N. J. **Electric starters.**

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CHAMPION IGNITION CO., Flint, Mich. **A. C. Spark Plugs.**

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EASTMAN KODAK COMPANY, Rochester, N. Y. **Automatic Aero Cameras.**

EBERHART STEEL PRODUCTS CO., 812 E. Ferry St., Buffalo, N. Y. **Accessories; parts.**

ELECTRIC STORAGE BATTERY CO., Allegheny Ave. & 19th St., Philadelphia, Pa. **Ignition, Starting and Lighting batteries.**

ENDICOTT FORGING & MFG. CO., INC., Endicott, N. Y. **Drop Forgings.**

FAIRCHILD AERIAL CAMERA CORP., 136 W. 52nd Street, New York City. **Aerial Mapping Cameras and Aerial Maps.**

GENERAL ALUMINUM & BRASS MFG. CO., East Grand Blvd. and St. Aubin Ave., Detroit, Mich. **Motor bearings; Aluminum, Brass and Bronze Sand Castings.**

THE B. F. GOODRICH RUBBER CO., Akron, Ohio. **Airplane tires; molded and mechanical rubber goods.**

GREAT LAKES AERIAL PHOTOGRAPHIC CO., 11511 Mayfield Road, Cleveland, Ohio. **Aerial Mapping and Photographs.**

HAMILTON AERO MFG. CO., Milwaukee, Wis. **Propellers.**

STEWART HARTSHORN COMPANY, 250 Fifth Ave., New York City. **Streamline wire; Streamline wire to rods; Universal and fittings.**

HASKELITE MFG. CORP., Chamber of Commerce Bldg., Chicago, Ill. **Veneer; Plywood.**

JOHNSON AIRPLANE AND SUPPLY CO., Dayton, Ohio. **Parts, Accessories, Equipment and Supplies for all types of planes.**

LINDE AIR PRODUCTS CO., 20 E. 42nd St., New York City. **Hydrogen tanks.**

MACWHYTE COMPANY, 1220 Racine Ave., Kenosha, Wis. **Streamline, wires, Fittings, Brutonized Airplane Wire Cables.**

C. L. MAGUIRE PETROLEUM CO., McCormick Bldg., Chicago, Ill. **Lakeside Aviation Oil.**

MEISEL PRESS MFG. CO., 944-948 Dorchester Ave., Boston 25, Mass. **Gears; Sprockets; Screw machine products; Heat treating.**

MOSLER METAL PRODUCTS CORP., Mt. Vernon, New York. **Spark plugs.**

NEW JERSEY VENEER CO., Lakeview, Paterson, N. J. **Veneer; plywood.**

NEW YORK BLUE PRINT PAPER CO., 102 Reade St., New York. **Blue prints.**

PARK DROP FORGE CO., Cleveland, Ohio. **Crank shafts.**

PERRY AUSTEN MFG. CO., Greenevc, S. I., N. Y. **Lacquers and wing dopes.**

PIONEER INSTRUMENT COMPANY, 754 Lexington Ave., Brooklyn N. Y. **Aircraft instruments and Accessories.**

RADIO CORP. OF AMERICA, 233 Broadway, New York City. **Radio Apparatus.**

RICH TOOL COMPANY, Railway Exchange, Chicago, Ill. **Poppet Valves.**

THE SIMMS MAGNETO CO., East Orange, N. J. **Magnetos; Lighting and starting equipment.**

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SKYWRITING CORPORATION OF AMERICA, 50 E. 42nd St., New York. **Skywriting.**

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WOLVERINE LUBRICANTS CO. OF N. Y., 44 Whitehall St., New York. **Wolf's Head Aviation Engine Lubricants.**

WYMAN GORDON CO., Worcester, Mass. **Crank shafts.**

THE ZENITH CARBURETOR CO., Foot of Hart Ave., Detroit, Mich. **Zenith Carburetors and parts.**

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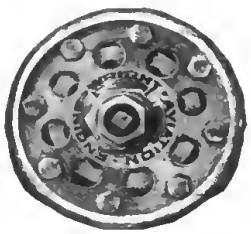

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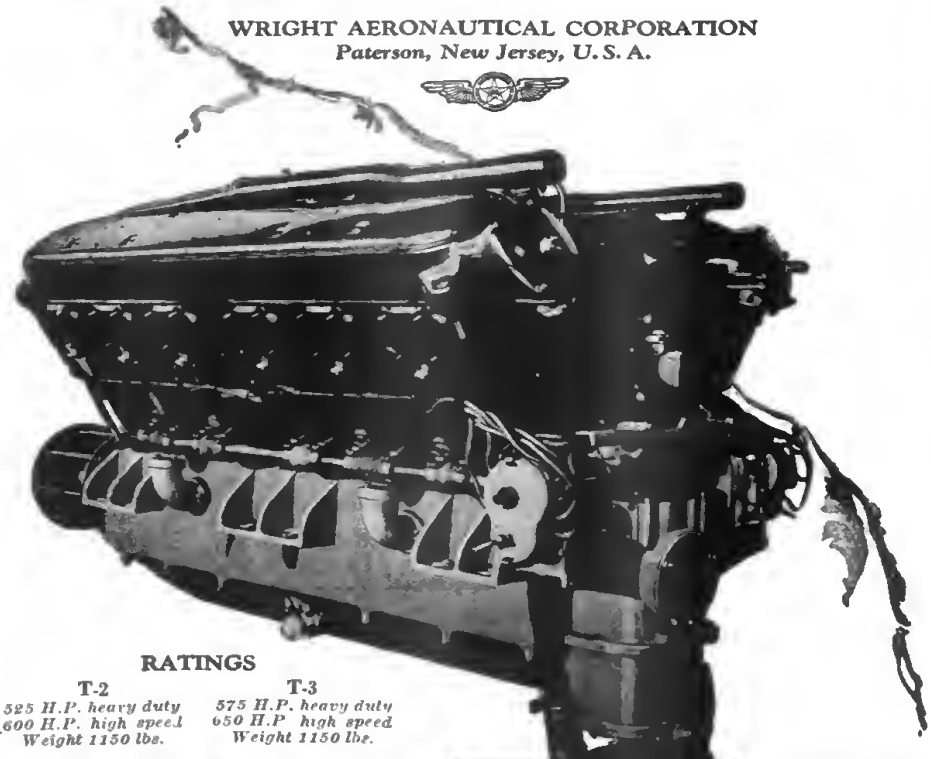

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